

JPRS 76024

10 July 1980

China Report

SCIENCE AND TECHNOLOGY

No. 44



FOREIGN BROADCAST INFORMATION SERVICE

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CHINA REPORT

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CONTENTS

NATIONAL DEVELOPMENTS

Eastern Route for South-North Water Diversion Project Deemed Unsuitable (GUANGMING RIBAO, 18 Mar 80)	1
Jinci Springs Restored, Harnessed (Liu Qun; GUANGMING RIBAO, 18 Mar 80)	4
Problem of Defective Fuel Injectors Now Resolved (Zhang Tianlai; GUANGMING RIBAO, 18 Mar 80)	6
Consulting, Advising Methods Reported (Xu Guoquan; GUANGMING RIBAO, 18 Mar 80)	8
Fullest Use of 'Brain Trust' Urged (GUANGMING RIBAO, 18 Mar 80)	12

PHYSICAL SCIENCES

Rock Acoustics Research in China Reported (DIZHI LUNPING, Jan 80)	14
Research on Pre-Sinian Metamorphic Iron Deposits in Eastern Hebei (DIZHI LUNPING, Jan 80)	16
Discovery of Native Ruthenium in Guangdong Reported (Lin Yuchuan, Chen Keqiao; DIZHI LUNPING, Jan 80)	18

APPLIED SCIENCES

New Chinese Character Input Scheme Developed (TIANJIN RIBAO, 11 Jun 80)	23
Modern Cipher Modern Communications Described (Shao Yabao; KEXUE HUABAO, Aug 79)	25
Aspects of Ship Design Analyzed (CHUANBO GAILUN, 29 Mar 79)	30
Performance of Slotted-Nozzle Dual-Ducted Propellers Studied (Ye Yuanpei, Shen Yide; ZHONGGUO ZAOCHUAN, Apr 79) ..	44

SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

Chinese Academy of Sciences Holds Academic Department Meeting (GUANGMING RIBAO, 6 Apr 80)	84
New Institute Established in Sichuan University (Qui Peihuang; GUANGMING RIBAO, 7 Apr 80)	86
Biomedical Committee Established in Jiaotong University (Zhen Yifang; GUANGMING RIBAO, 7 Apr 80)	87

ABSTRACTS

MICROBIOLOGY

WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA], No 1, Mar 79	88
---	----

NATURAL SCIENCES

XIAMEN DAXUE XUEBAO--ZIRAN KEXUE BAN [JOURNAL OF XIAMEN UNIVERSITY--NATURAL SCIENCES EDITION], No 1, Feb 80	105
--	-----

OCEANOGRAPHY

HAIYANG YU HUZHAO [OCEANOLOGIA ET LIMNOLOGIA SINICA], No 3, Jul 79	116
---	-----

PHYSICS

GAONENG WULI YU HEWULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS], Nos 5, 6, Sep-Nov 79	121
--	-----

PHYTOPHYSIOLOGY

ZHIWU SENGLI XUEBAO [ACTA PHYTOPHYSIOLOGIA SINICA], No 2, May 79	138
---	-----

PUBLICATIONS

Selected New Scientific, Technical Books	146
--	-----

NATIONAL DEVELOPMENTS

EASTERN ROUTE FOR SOUTH-NORTH WATER DIVERSION PROJECT DEEMED UNSUITABLE

Beijing GUANGMING RIBAO in Chinese 18 Mar 80 p 2

[Article: "Eastern Route Deemed Unsuitable for Northward Diversion of Water From South According to a Group of Hydrogeologists on the Basis of the State of Water Resources in the Region of the Yellow, the Huai, and the Hai Rivers"]

[Text] Mao Tongxia [3029 0681 1115] and more than 50 other hydrogeologists from geology units recently conducted further surveys and calculations on the state of water resources on our country's Yellow River, Huai' iver, and Hai River plains. Their preliminary results are that the eastern route for the northward diversion of water from the south is not suitable and that greatest care must be exercised. At the same time they put forward important proposals on how, while adhering to natural laws, to make rational development and use of underground water resources of the plains of the Yellow, Huai, and Hai rivers, and to treat, in a comprehensive manner, the problems of drought, waterlogging, and salinity on the plains of the Yellow, Huai, and Hai rivers.

Under the solicitude and support of the CCP Central Committee and the State Council, the China Science and Technology Association and the State Scientific and Technological Commission began in July last year to center their attention on the projected great diversion project for movement northward of water from the south. On several occasions they organized numerous disciplines for technical discussions that transcended separate professions and industries. They gave fullest reign to the advice and counsel of experts in different fields including science and technology, technical economics, and technical politics. Numerous geological scientists and technicians showed warm concern for and actively participated in this important academic discussion. Last autumn, in order to clarify a controversial major premise bearing on the northward diversion of water from the south -- the state of water resources on the plains of the Yellow, Huai, and Hai rivers and the laws governing their changes -- the Ministry of Geology convened a conference at Xinxiang attended by delegates from the seven provinces and municipalities in the Yellow, Huai, and Hai region to assign survey and scientific research tasks. Following the conference, more than 50 hydrogeologists were organized; hydrogeological data collected through the arduous labors of several tens of thousands of people in the 20 years following the founding of the People's

Republic were brought together; data from 4,906 dynamic observation points were analyzed; 1,811 water level curves were studied, and 2,355 parameters were calculated. From this foundation they came up with numerous very good recommendations, foremost of which are the following:

First, in view of the existing state of water resources on the more than 280,000 square kilometers of plains of the Yellow, Huai, and Hai rivers, a rather great potential varies from area to area. If it were possible to tap further in a rational way the shallow layer of underground water, to effectively transform the saline underground water, to regulate storage of precipitation and surface water, as well as to remake the irrigation zones along the rivers, and take other such technical and economic measures, the whole area could annually be expanded to provide more than 40 billion cubic meters of water, of which regions north of the Yellow River could provide 13 billion cubic meters. The tapping of the potentialities of these water resources, together with conservation in the use of water, could virtually satisfy the water requirements set forth in the former plan for diverting southern water northward via the eastern route. The water shortage of some areas conceivably could be solved through adjustments within the local drainage area.

Second, there must be unified planning, overall consideration, and integrated control of the plains of the Yellow, Huai and Hai rivers so as to greatly increase their capabilities to resist drought and waterlogging, and to prevent or control the alkalization and salinization of the soil. One cannot wait to control drought when drought is at hand, or control waterlogging when waterlogging is at hand, or control alkalization when alkalization is at hand. The central problem in comprehensive control is combined use of surface water and underground water, rational regulation of water resources, and the creation of a balanced situation between beneficial water and salts. It is necessary to take to heart the lessons of experience in water conservancy work done during the late 1950's and during the 1960's. During the latter part of the 1950's, a great effort was made to build water catchments on the plains and to construct large irrigation zones by channeling the waters of the Yellow River. The result was a rise in the underground water table and the salinization of large stretches of land. During the 1960's, the catchments were abandoned and the canals leveled. Ditches were built instead to drain water away, and wells were sunk with abandon. Because water was tapped without being replenished, the water level fell year after year in some areas in a "funnel" effect. These problems are not unavoidable when using surface water or underground water, but are created by making plans for water use without regard for natural laws.

Third, a top priority matter is the rational exploitation and use of local underground water and surface water using scientific methods to "flush away the salt and replenish the fresh water," energetically using and transforming the brackish underground water. In locales where water resources have not been fully exploited or put to use, before the underground saline water has

has been basically transformed, any large-scale diversion into the area of water from elsewhere would be a repeat performance of the problems that showed up in the channeling of the waters of the Yellow River during 1958, and would thus not be suitable. There must be caution and more caution.

9432

CSO: 4008

NATIONAL DEVELOPMENTS

JINCI SPRINGS RESTORED, HARNESSSED

Beijing GUANGMING RIBAO in Chinese 18 Mar 80 p 2

[Article by Liu Qun [0491 5028]: "The Story of Jinci Springs"]

[Text] A story has been making the rounds recently in Shanxi about scientists harnessing Jinci Springs.... Jinci Springs is one of the places of historic interest and scenic beauty in our country, located at the foot of the Xuanweng Mountains 25 kilometers southwest of Taiyuan. It was built more than a thousand years ago during the Northern Qi Dynasty in the reign of the Tianbao emperor (550 - 560 A.D.) for Tang Jiaoyu [0781 2403 5713], the monarch who founded the Kingdom of Jin. During the Tang Dynasty in the reign of Zhenguan (627 - 650 A.D.), its name was changed to Jinci. Within the ancestral temple are ancient structures such as the Hall of the Sacred Mother and the Tower of the Mother of Waters as well as treasured historical relics such as the ancient Chinese scholar trees of Zhou Botang [0719 2672 0781] and statues from the Song Dynasty (960 - 1126 A.D.). Most enticing to tourists is the Nanlao Spring within the temple, whose waters are clear enough to see the bottom, and which has been bubbling since time immemorial. According to local annals, no increase or decrease in this spring occurs as a result of flooding or drought. The water that flows from this spring irrigates between 30,000 and 40,000 mu of paddy fields. According to measurements made by the hydrological station, the volume of water flowing from Nanlao Spring averages 1.8 tons per second. This is a lot of water. In recent years, however, a gradual decrease has occurred in the volume of flow of the waters from Jinci Springs, which has flowed uninterruptedly for a thousand years. Flow per second has declined by more than one-half to only 0.8 tons. Water from two of the springheads has dried up; the lotus pond is dry and the fish pond is dry; and water is no longer sufficient for the Jinci Springs irrigation field. This situation not only spoils the scenery for tourists, but fights frequently break out over water among the people travelling back and forth. Why has this happened to a spring that has flowed unceasingly for a thousand years? Is there any way to remedy it?

In early 1979, the Shanxi Provincial CCP Committee and the Taiyuan Municipal CCP Committee handed this problem of Jinci Springs, which concerned everybody, to the Municipal Scientific and Technical Association and to the Municipal

Institute of Water Conservancy for solution. They gladly accepted this task. More than 50 scientists and technicians in more than 30 units concerned, such as water conservancy, geology, coal, and municipal building accepted invitations to participate in an "Academic Discussion Conference On Jinci Springs". At the conference, water conservancy engineer Sang Zhida [2718 1807 6671] made a report titled, "Use of Satellite Photographs to Understand Jinci Springs." Liu Xitian [0491 6932 3944], chief engineer of the Water Conservancy Bureau, and Qian Xuepu [6929 1331 3302], chief engineer of the Geology Bureau, made academic reports, which evoked the interest of and heated discussion by the scientists and technicians attending the conference. In the course of several days of academic discussions by everybody about the hydrological and geological situation, the reasons for the gradual drying up of Jinci Springs was analyzed. Jinci is located at the foot of Luliang Mountain, and the area of the spring is located in the middle reaches of the meandering water course of the Fen River. The spring results from the underground pooling of water along a fault that runs along the edge of the Luliang Mountain. Pressures are great, exceeding the elevation of the land surface, so water flows out by itself.

But why should it gradually dry up? One idea was that it was due to the new industrial area that runs along Luliang Mountain, particularly the large number of wells sunk there by the Pingchuan Brigade in Qingxu County. Another thought was that the well water in Pingchuan had nothing whatever to do with the Jinci Springs; that they derived from different sources. Given the large amounts of scientific data and scientific experiments at hand, the two views were finally reconciled. Within the spring area and running along the edge of Luliang Mountain, the unplanned and excessive tapping of water by plants, mines, communes, and brigades had caused a gradual drop in the Jinci Springs and was the basic reason for their drying up. After presentation of technical and economic proof of this contention, a permanent cure was proposed under the auspices of the institute, namely no further tapping of water, control of use, sealing of wells, and a return to watering by hand. In addition, there should be further scientific studies of Jinci Springs. This academic discussion evoked the serious attention of the Shanxi Provincial CCP Committee and the Taiyuan Municipal CCP Committee. The Municipal CCP Committee required that efforts be made to restore the water flow in Jinci Springs to 1.4 tons per second. And now the water conservancy units concerned have, following the lead of the scientists, begun to cap two wells, to set up an administrative organization for the Jinci Springs water sources, and to enhance planning and technical guidance for the development of subterranean water in the spring region. Units concerned in Taiyuan Municipality are in process of discussing arrangements for a gradual and rational solution at Jinci Springs.

It may be predicted that very soon when you walk into Jinci and stand beside the Nanlao Springs, listen to the gurgling waterflow, and see the beautiful scene of lotus flowers poking above the water and gold fish leaping, you may praise the intelligence and wisdom contributed by the scientists to Jinci Springs.

9432

CSO: 4008

NATIONAL DEVELOPMENTS

PROBLEM OF DEFECTIVE FUEL INJECTORS NOW RESOLVED

Beijing GUANGMING RIBAO in Chinese 18 Mar 80 p 2

[Article by correspondent Zhang Tianlai [1728 1131 0171]: "Victorious Farefare for Diesel Engines; Hunan Provincial Mechanical Engineering Institute Focuses on an Important Example in the Organization of Academic Activities for the Four Modernizations"]

[Text] The diesel engines are playing a lively melody and turning at full speed. Each minute they turn 1,500 revolutions. From 5 March 1979 until the present, they have turned for more than 5,400 hours each year. They are continuing to sing. Two such diesel engines in the Changsha Tractor Spare Parts Plant are using fuel injectors manufactured by new technology. Their life has already exceeded the highest record attained in tests for the life of domestically made diesels (3,500 hours).

This is an important outcome of Hunan Provincial Mechanical Engineering Institute's organization of scientists and technicians to surmount technological difficulties, and it is a rather outstanding example of the important significance of the activities of the Chinese Science and Technology Association explained at its "Second Congress."

....suddenly the flame in the churning diesel engines dies away and its throat becomes mute. The moving water pump ceases to pump water and the tractor runs no longer ... everything comes to a halt. People check here and check there. The main cause lies in the fuel injector. The fuel injector has become the most important of a hundred key parts for machine industry units. What is a key part? It means that it determines the life of the product. The key to whether the life of a diesel engine will be long or short is whether the fuel injector is good or bad. The life expectancy set by machine units is 1,500 hours; however, some of the fuel injectors made by some farm machinery plants in Hunan Province "die a natural death" after only 700 or 800 hours of use. Unless the fuel injector is changed, you can forget about getting the diesel engine to turn again. As a result, during the busy farming season fuel injectors cannot be bought anywhere, because no matter how many your plant makes, it cannot keep up with the speed at which they wear out.

The Provincial Science Commission has also designated this a major subject for scientific study and has promulgated units concerned to conduct experiments, but for some unknown reason they were stopped in midcourse. At the founding conference of the Heat Treatment Studies Unit of Hunan Provincial Mechanical Engineering Institute in 1978, this unit's scientists and technicians took the lead in placing this task on its own shoulders. Professors from institutions of higher education jointly analyzed and researched, very quickly finding the reason for the short life of the fuel injectors. The hardness specification for the fuel injectors was 62 degrees, and the tempering heat of 160 degrees met this specification; however, the fuel injectors ordinarily operate at high temperatures of 250 degrees. Consequently, their degree of hardness rapidly declines and naturally their life cannot be very long. Obviously these heat treatment standards are extremely unreasonable. They discussed this situation over and over, and promulgated new heat treatment experimental specifications for the fuel injectors. They then carried out experiments at two separate plants.

These experiments were all carried out after hours at the plants and were conducted jointly by engineering technicians, workers, and professors. The man in charge of the problem was Wu Lizheng [0702 4539 6927], deputy director of the Heat Treatment Studies Unit and engineer at the Tanjianglu Machinery Plant in Hunan. Chen Zhengping [7115 2398 1627] was the advisor to the Heat Treatment Studies Unit and engineer in the Hunan Provincial Machinery Bureau. Both had abundant practical experience, and they had the benefit of several years in the practical and effective methods used in several plants of the national defense system. Within a short time they made ten specimens as specified in the plan for the experiment. They selected two of these at random and installed them on two diesel engines at the Changsha Tractor Spare Parts Plant. The result is that as of the time of the writing of this draft, they are still in normal operation.

There are two interludes that should be related here. After operating for more than 3,700 hours, major repairs were made on the diesel engine with the cylinder jacket, the pistons, and other parts being changed, but there was still nothing wrong with the fuel injector. It operated for 4,588 hours, during which the valves and the fuel pump broke down and were changed. Only the fuel injector was still as good as new.

A motorized sailboat is cruising on the azure Xiang River. Aboard this vessel of the Changsha Municipal Water Transportation Company are four diesel engines fitted with this long life fuel injector. As of now they have operated on the Xiang River for close to 2,000 hours and they are still purring along with no expectation that they will quit anytime soon.

Please note such an important but formerly unsolved problem, yet once the institute went into action using its no small authority, it was solved so well. This vividly demonstrates that within scientists and technicians reposes the greatest intellectual resources, and the activities of the institute are an extremely effective form for developing these resources.

NATIONAL DEVELOPMENTS

CONSULTING, ADVISING METHODS REPORTED

Beijing GUANCHING KINAO in Chinese 18 Mar 80 p 2

[Article by Xu Guoquan (1776 0948 2938): "Good Staff Officers Needed for Four Modernizations. A Briefing on Several Ways in Which the Shanghai Municipal Science and Technology Association Made the Most of Consulting and Advising"]

[Text] If we intend to bring about the four modernizations by the end of this century, the key lies in strengthening and improving the leadership of the party, because the party is the commander of the four modernizations. However, to have nothing but a commander will not do. There have to be good staff officers too. The 5 million or so scientists and technicians throughout the country are both a mainstay of the four modernizations and good staff officers for the four modernizations. In order to make the most of their function as consultants and advisors to four modernization construction, the Shanghai Science and Technology Association has been using the following effective methods for the past year and more.

1. Publication of "Views of Scientists and Technicians to provide a channel to scientists and technicians for voicing their ideas. The scientists and technicians of our country love their country very much. Though their bodies may dwell in humble homes, their hearts think of the four modernizations. But they are frequently frustrated with being unable to reflect their own views and suggestions to leadership organizations in a timely fashion. Shanghai municipality's Science and Technology Association took account of this situation, founding in October 1978 "Views of Scientists and Technicians", a publication for internal use only. Through this publication, scientists and technicians have already proposed more than 50 quite important recommendations with a bearing on national technical policies, emphasis on structural engineering, planning and execution of scientific and technical development, training and use of skilled people, environmental protection, urban construction, and increased production while practicing economy, and on foreign trade. Most such recommendations were quite realistic and workable, and they were welcomed by all echelons of leadership.

2. Combined academic activities; offered advice and made suggestions for the four modernizations. The Shanghai Science and Technology Association usually

conducts large numbers of academic activities, many of which are directly related to current building of the four modernizations. These offer good prospects for continuously expressing ideas for the country and for being combined with staff advice. For example, since the resumption of work by the Shanghai Science and Technology Association, 36 societies have held annual meetings at which a total of more than 9200 papers have been presented, a large number of which contained very good proposals on current scientific and technical problems and on four modernizations construction. Timely reporting to the leadership of these good ideas serve an advisory function. Whenever academic discussions and academic study activities sponsored by societies have a direct bearing on four modernization construction, the Science and Technology Association invites appropriate executive unit leaders to come listen or else organizes views and suggestions into a written report for the quarters concerned. For example, after the Silicate Society had studied columbite tailings, it wrote up composite recommendations for the use of these tailings, which received serious attention from those concerned.

3. Formed on major problems and organized experts from many scientific fields to give advice. Beginning in September last year, the Shanghai Science and Technology Association organized more than 400 agricultural specialists, teachers, and scientists and technicians from more than 60 academic societies to make a wide-ranging examination of the levels of agricultural modernization in the Shanghai suburbs, its direction, programs and policies, and techniques. Numerous good ideas were put forward, which received the serious attention of leaders in the municipal government; and in the counties. Recently, the Association again organized more than 180 specialists in 19 different academic societies and research societies concerned with petroleum, metals, electrical machinery, engineering thermophysics, atomic nuclei, solar energy, and biological energy to launch academic discussions of energy problems. This concentration on major problems with discussion by many disciplines provides stimulation to the intellect, pools collective wisdom, prevents fragmentation, and is geared to actual circumstances. It is welcomed by all.

4. Established an advisory service organization and accepted commissioning of advice. Some associations set up special advisory units. These organizations were of two kinds: those having fixed and permanent duties, and those that were ad hoc in nature. Selection of personnel for the permanent organizations was done by society specialists and were an integral part of the society. Their duties consisted of accepting requests from all quarters for advice on difficult problems. For example, the advisory unit of the Scientific Management and Technical Economic Study Society performed a technical economic analysis of a construction plan for the foundry of a certain plant. Another kind of duty was responding to requests for advice from pertinent units with the temporary invitation to specialists to form a small unit, with the unit being disbanded after completion of its tasks. For example, the Corrosion Prevention Society solved a problem of tough film anti-rust oil for the Machinery Import and Export Company, and the Packaging Research Society researched a problem with bottle capping machines for a household chemical products plant. These were both of the ad hoc type. In the former, some

permanent members were the mainstay, which made accumulation of experience easy. The latter was fluid and flexible.

5. Organized appraisals from within the industry and instituted consultation on personnel problems. Consultation on personnel problems differs from consultation on technical problems. If done badly, it can impair the unity and the enthusiasm of scientists and technicians. Consequently, whenever the Association received a request for consultations on personnel problems, it mostly used the methods of small discussion forums or separate inquiries to hear views. For example, when the Municipal Scientific Committee wanted the Association to get an appraisal from others in the same profession on the Chinese Academy of Sciences' supplemental education department's committee member personnel selection organization, these two methods were used. Altogether more than 50 scientists' views were heard and 11 candidates for selection individually put forward their own appraisals. The Municipal Scientific and Technical Cadres Office and the Municipal Agricultural Committee Cadre Office commissioned the Association to undertake an evaluation by research personnel of 12 scientists and technicians for promotion to deputy research personnel. Naturally when the Dialectics Study Society received a request from the appropriate unit to provide a consulting opinion on the promotion of the members, they used this method. Some institutes have also organized specialists to formulate technical standards for technologies that have newly appeared to serve as data for the grading of technicians.

6. Set up an advisory committee to provide consultation on key projects. In order to provide assistance for a good job on the key Baogang Steel Mill project, the Association invited, in response to a request from the Baogang Project Command, 24 specialists and professors from Shanghai municipal institutes of metallurgy, mechanics, civil engineering, water conservancy, and automation to form the Baogang Advisory Committee. Following approval by the Shanghai Municipal CCP Committee and the Ministry of Metallurgy, they were formally issued letters of appointment, and this constituted advisory committee had authority to make proposals, authority to deliberate on important technical problems, authority to participate in important Baogang scientific and technical activities, authority to inspect all matter of technical materials, authority to be fully informed about the progress of all projects, and to help summarize practical experiences. In order to accommodate the advisory committee in the initiation of its work, various subordinate specialized units were established as counterparts to pertinent units at Baogang. Concerned institutes in Shanghai were the backup for the advisory committee, and when the advisory committee confronted a major problem, it could request specialists from these institutes to study them jointly. Such a formula, it seems is a rather good one for using specialists and advisors to the fullest extent on large projects or systems, or in large units to which the leadership is giving great attention.

7. Organized scientists and technicians for fixed periods of duty and launched a consulting service. In recent years the Electronic Instrument Technical Society of the Science and Technology Association has established a system of revolving duty periods for members in response to the demands of

numerous units for consulting services. They prescribed a half day of duty each week during which time any unit with a difficult technical problem pertaining to electronics could come forward for consultation. Some people referred to this as a "technical clinic." Some problems were solved on the spot in what was termed, "outpatient service." In cases where other units had already solved the problem, the requester was put in touch with them to profit from their experiences. This was called "referral." In response to a request from the Shanghai Motor Vehicle Transportation No. 6 Plant for consultation, this "technical clinic" helped the plant successfully test manufacture a remote sensing electric shock protection device to avoid accidents from electric shock in the course of work. This device became the most popular item in the municipal communication and transportation system. Such consulting services, most of which solve problems in production technology or applied technology, are well received by manufacturing plants.

Through the Association's giving full play to consulting and advisory services of specialists, not only will it make a greater direct contribution to four modernizations construction, but it will also strengthen the connection between the party and scientists and technicians and greatly arouse their enthusiasm.

9432

CSO: 4008

NATIONAL DEVELOPMENTS

FULLEST USE OF 'BRAIN TRUST' URGED

Beijing GUANGMING RIBAO in Chinese 18 Mar 80 p 2

[Article: "Give Free Rein to the 'Brain Trust' in Scientific Cooperation"]

[Text] A greater contribution of individual intelligence and wisdom in getting the magnificent undertaking of the four modernizations underway is the common aspiration of the broad masses of scientists and technicians in our country at the present time. Our country has more than 5 million scientists and technicians, which though a small number in comparison with the total population, are nevertheless the most precious intelligence resource for our country's realization of the four modernizations. Fullest development and use of this intelligence resource will require the common efforts of all quarters in organizing this force, and a planned and goal-directed close meshing with the requirements of construction in the four modernizations, to give full play to their roles as "idea banks" and "brain trusts." The several reports and dispatches appearing on this page today use living examples to demonstrate how the science and technology association and its subordinate organizations can have a real function in this.

During the more than 2 years since the revival of activities by the China Science and Technology Association, the vigorous support of the State Council's departments and commissions, this aspect of work has begun to show results. For example, whether or not the work should be begun at once on the project for diversion of southern waters to the north; how modernization of agriculture can be accomplished in the northeast region; how to solve the great technical problems on the Shanghai Baogang engineering project; as well as whether or not the design of the Beijing Tourist Building makes sense; and how to develop rapidly production of our country's finest black teas. Many scientific and technical proposals have been made for all these questions, and they have received the serious attention of the central government and pertinent departments. Some consulting service work has directly promoted increased production and economies. For example, when a boiler in a Guangzhou plant developed a crack, past practice would have dictated that it be scrapped. While replacement was being awaited, loss in production would run to 10,000 yuan per day. Furthermore, throughout the country there were several score of this same type boiler in similar condition. But after experts from the appropriate institute of the Guangdong Provincial Science and Technology Association applied theories of fracture mechanics to analyze and calculate, they concluded that the boiler was still

within the limits of safety coefficients and could continue to be used, thereby solving that difficult problem. In another case, at a certain place the pier of a newly constructed large bridge developed cracks. If it were dynamited and rebuilt, more than 3 months time and 300,000 yuan would be required. Following "consultation" with an expert from the Chongqing Municipal Silicate Institute, who prescribed use of epoxy resin to make repairs, only a week's time and 30,000 yuan were required to repair the bridge and bring it up to specifications.

In the history of our Chinese people from ancient times to the present, countless scientists endowed with intelligence and wisdom have appeared. At the present time, Chinese hold prestigious positions among the scientific and technical ranks of experts in foreign countries where they are playing important roles. In the case of the United States alone, for example, various famous American universities have Chinese as directors of one-third of their departments; one-third of the high ranking engineers on the Apollo moonlanding project were Chinese. America's largest electronic computer monopoly enterprise, the International Business Machine Company, which produces about 90 percent of the world's electronic computers, has Chinese as one-third of its high ranking engineers. Half of this company's 800 high ranking researchers are Chinese. That the Chinese are an intelligent race of people is founded in facts. We must have complete confidence in reliance on our own intellectual resources to realize the four modernizations.

All echelons of S&T associations should develop and use these intellectual resources to make a greater contribution and to better make use of the role of the "brain trust." At the moment there are several problems requiring their attention. First is the need for fullest attention to scientific practices and the constant raising of the levels of scientific thought. Only when theory and practice are combined can the "brain trust" play a real role, and only then can they be good advisors and staff officers. Those without real ability and learning are not fit to be a "brain trust." Empty talk, useless talk, and false talk that is without scientific basis or scientific content cannot be termed a "brain trust." Second there must be a clear conception of the objective of activities of the "brain trust." It must solidly, sequentially, and undauntedly study and solve the practical problems of construction in the four modernizations, particularly the scientific and technical problems in some major construction projects, technical economic problems, and technical political problems, or else pioneer new ways of thought for the solution of these problems in a scientific way, pointing the direction, and predicting the future. They must march forward courageously, undauntedly, and without giving up halfway along the way. Third, organizational forms suitable to our country's situation must be explored with matters being handled according to the objective laws governing scientific work and economic work. Stress must be placed on efficiency, and every undertaking must be run industriously and thriftily, without formalism, and with no establishment of bureaucratic organizations. Fourth, there has to be energetic initiation and operation of a fine style of collectivism. Only a good style can bring about ingeniousness.

Great goals produce tremendous motivation, and a lofty style gives rise to persons of outstanding talent. In celebrating this day of victorious convening of the "Second Congress" of the China Science and Technology Association, it is hoped that comrades in scientific and technical endeavors will encourage one another.

PHYSICAL SCIENCES

ROCK ACOUSTICS RESEARCH IN CHINA REPORTED

Beijing DIZHI LUNPING [GEOLOGICAL REVIEW] in Chinese Vol 26 No 1, Jan 80
p 76

[Article by Experiment Work Management Division, Chinese Academy of Geological Sciences: "The First Results in Research on Rock Acoustics"]

[Text] This is a fact: When rocks and minerals are heated, they disintegrate, release inclusions and undergo facies transformation while emitting characteristic sounds. This kind of natural phenomenon is known as "heat-sound effect." As various kinds of rocks and minerals receive heat radiation at the same temperature, their sounds differ in intensity and frequency spectrum. Another type of phenomenon is known as the "light-sound effect," i.e. as monochromatic lights of different wavelengths are shone on rocks and minerals, various kinds of chemical elements absorb different wavelengths of energy and emit sounds. Through the light-sound effect, it is possible to study the contents of various elements. As the rocks are subjected to continuous pressure, they also emit different sounds while experiencing deformation. This is known as "sound emission." When high frequency sound waves pass through rocks, their propagation velocities, amplitudes and wave forms also change, which thus makes it possible for us to obtain various kinds of acoustical parameters.

Over the past 10-odd years, the acoustical principles of "heat-sound effect," "light-sound effect" and "sound emission" have been applied in lithology, mineralogy and other areas of research in foreign countries. In geology, they have gradually formed into a branch known as "rock acoustics." Besides helping to identify and study problems related to rocks and minerals, it can also be used for solving problems related to engineering geology and seismic geology, as well as for guiding mineral exploration work. Compared with other optical and acoustical research areas, rock acoustics uses light and convenient instruments; it has high sensitivity and good resolving ability, and it is easy to master, which makes it a research field with great prospects for development.

In order to promote the modernization of geological scientific research work, this year, the Experiment Work Management Division of the Chinese Academy of Geological Sciences organized the laboratories of the Changchun Geological Academy, and the provincial geological bureaus of Jiangxi, Gansu, and Guangdong to conduct acoustical and mechanical tests of many kinds of rocks (over 400 pieces of specimens) with combined applications of foreign and Chinese methods, thus obtaining large volumes of test data, stress variation curves, pressure-deformation- and emission relation graphs, pressure-deformation-amplitude attenuation graphs, etc, and results have been achieved in the following aspects:

1. Identification of some rocks: For example, with conventional methods, it was relatively difficult to distinguish metamorphic granite-gneiss from amphibolite rocks of the region. But since there is a relatively great difference between the acoustical characteristics of the two rocks, i.e. the accumulation value and time course of sound emission, it became comparatively easy to identify the rocks with acoustical method.
2. Relatively fast way of determining the mechanical properties of rocks. For example, with the help of longitudinal wave velocity (V_p) and transversal wave velocity (V_s), it is possible to determine such rock parameters as compressive strength and modulus of elasticity.
3. The exploratory research on the relationship between the acoustical characteristics and mineral contents of iron and cupre-nickel ores has led to the discovery of certain laws between mineral tenor and P-wave velocity, amplitudinal delay and sound emission characteristics, which enables the use of acoustical method in studying tenor variations, thus reducing chemical analysis work.
4. Research on the sound emission characteristics of many kinds of rocks under uniaxial compression conditions has not only been used for studying the mechanism of rock deformation and destruction, but also for accumulating fairly large volumes of basic materials for predicting natural earthquakes.
5. By summarizing high frequency transversal wave techniques used for testing rocks, a complete set of related equipment has been developed, thus narrowing the distance between our country and foreign advanced levels.

Moreover, we have accumulated fairly good experiences in data processing.

PHYSICAL SCIENCES

RESEARCH ON PRE-SINIAN METAMORPHIC IRON DEPOSITS IN EASTERN HEBEI

Beijing DIZHI LUNPING [GEOLOGICAL REVIEW] in Chinese Vol 26 No 1, Jan 80
p 87

[Article by the Eastern Hebei Geological Headquarters of the Hebei Geological Bureau: "The Encouraging Achievements of Scientific Research Work on the Pre-Sinian Metamorphic Iron Deposits in the Eastern Part of Hebei Province"]

[Text] On August 22-28, the Hebei Provincial Branch Society of the Chinese Geological Society and the Tangshan Prefectural Geological Society jointly sponsored an "Academic Exchange Forum on Pre-Sinian Metamorphic Iron Deposits in the Eastern Part of Hebei." Held in Qinghuangdao City, the forum reviewed the results achieved over the recent years in scientific research on pre-Sinian metamorphic iron deposits in the eastern part of Hebei Province.

Besides representatives from our own province, there were also concerned scientific research organizations, colleges and universities and representatives from neighboring provinces and cities (Liaoning, Nei Mongol, Shanxi, Henan, Tienjin City) at the academic exchange forum, totaling 57 organizations and 150 participants. The overwhelming majority of the participants were specialists, professors and scientific and technical workers who had many years of experiences in field work research on pre-Sinian metamorphic iron deposits. They were all extremely happy to get together for extensive academic exchanges under the party's guiding policy of "letting a hundred flowers bloom and a hundred schools contend." Everyone spoke rather freely, presenting their own ideas and arguments, learning from each others' strong points, and thus gained a lot from the meeting.

Altogether, 46 academic theses were handed in, 26 of which were presented at the forum. The theses were extremely rich in content, and remarkable progress was found in the following three aspects:

First, research on basic geological theories has been stressed and enhanced. Through research on the features of the local rock combinations, metamorphism, migmatization, etc, we have come up with new ideas on the division

of stratigraphic succession. In addition, we have also gained a better understanding of the structural frameworks of basements. Besides, our region has produced a fairly large volume of isotopic dating data determined with the rubidium-strontium isochronism method. To a certain extent, it has laid the foundations for further research on the pre-Sinian isotopic chronology of this region.

Second, research on the geological background of the region has received wide attention. Based on large volumes of geological data which had been accumulated over a great number of years, the participants at the forum presented some new scientific arguments on such problems as genetic environment, mineral control conditions, late period tectonic changes, and the formation conditions of rich iron deposits. They conducted extensive in-depth studies and discussions on the problems, and based on the various aspects of research as described above, they pointed out the direction for further extensive exploration of mineral deposits and the prospects of expanding old mining areas.

Third, many scientific research methods and means are being used, such as electronic processing of geophysical data, satellite photos, interpretation of aerial photographs, oxygen isotopic geology, mathematic geology, and research on associated accessory minerals and geochemistry, etc, which has provided an even greater scientific basis for deepening our understanding of the genetic environment and deposit features of metamorphic iron.

9119

CSO: 4008

PHYSICAL SCIENCES

DISCOVERY OF NATIVE RUTHENIUM IN GUANGDONG REPORTED

Beijing DIZHI LUNPING [GEOLOGICAL REVIEW] in Chinese Vol 26 No 1, Jan 80
pp 74-76

[Article by Lin Yuchuan [2651 3022 1557] of Central Laboratory, Guangdong Geological Bureau, and Chen Keqiao [7115 0344 2884] of the Institute of Mineral Deposit Geology, Chinese Academy of Geological Sciences: "Discovery of Native Ruthenium in Guangdong Province"]

[Text] Native ruthenium, the end member of the ternary Os-Ir-Ru system in the platinum group, was discovered in the ultrabasic rocks of Dadun Mountain, located in Yangchun County's South Lake (Nan Hu), Guangdong Province. In early 1976, a preliminary nomenclature was made on the basis of electronic probing data, and preliminary reports were published in limited circulations, i.e. Research on the Natural Deposits of Platinum-Palladium in the Oxidized Zone of Platinum-Bearing Ultrabasic Rocks in Dadun Mountain, South Lake, Yangchun County, Guangdong Province and Guangdong Geological Field Work Information (No 4, 1978). Beginning in 1978, we conducted in-depth research on this particular kind of mineral, and new tests were made to redetermine its composition and other physical properties. In addition, x-ray analyses were conducted with the help and guidance of Professor Peng Zhizhong [1756 1807 1013] of the Wuhan Geological College. The mineralogical research on native ruthenium has taken another step forward.

The native ruthenium specimens are kept in the Geological Museum of the Ministry of Geology.

Occurrence

Natural ruthenium occurs in the oxidized zone of platinum-bearing augite rocks which are emplaced in the marginal facies of masaiite rocks in the form of pipe-shape pseudo-minor rocks. The lithological character of the augite's terrene is partially metabiotite with magnetite-bearing augite which had been exposed to very acute weathering; the structure is loose and soil-like, and the color is brown yellow or brown. The platinum and

palladium contents in the oxidized zone is generally 0.2g/T, and bears 0.0001-0.013g/T of osmium. Generally, the platinum-palladium content of augite is slightly lower than oxidized zones. The chief metallic minerals in oxidized zones are magnetite, ferrohydrite, hematite; secondary metallic minerals are: washingtonite, soft manganese and pyrite. There are also small contents of arsenomargarite, chalcopyrite, megabasite and cobalt glance. Besides native platinum group minerals, sperrylite is another large group of mineral found among the oxidized zone specimens on the concentration table. Also discovered in the augite formation are such platinum group minerals as native platinum, cooperite, cooperite-palladium and stibiopalladinite. In addition, there are some native element minerals, such as native chromium, natural gold and natural bismuth.

Physical Properties and Optical Properties

Native ruthenium appears in the form of crystalline particles, measuring 20x24x30 microns in grain size. Silver white, strong metallic luster. The planes of the crystalline particles are partially uneven with occasional tiny pits. Unsoluble in hydrochloric acid and nitric acid.

Under a reflector, ruthenium is white in reflected light and shows weak anisotropism. With a Leitz Ortholux microscope and a MPV-1 microscope photometer, and based on WC data provided by the British NPL, the reflectivity value (R_z) of ruthenium is 64.4 for the visible light wavelength of 546 nm (measured by Chen Dianfen [7115 3013 5358] of the Chinese Academy of Geological Sciences).

Chemical Composition

The native ruthenium specimens were obtained from the oxidized zone of the platinum-bearing augite terrane in Guangdong's Yangchun. Two electronic probe analyses were conducted in conductive sand light plates.

The first electronic probe analysis was conducted in January 1976 by the Guilin Institute of Metallurgical Geology. The instruments consisted of a Japanese EB-3 electronic probe; the x-ray take-off angle was 52.5 degrees, and the working voltage was 25 Kev. In the second electronic analysis, the measurement instruments consisted of a Japanese JSM-35 scanning electronic microscope; the take-off angle of some of the x-rays from the electronic probe was 35 degrees; the working voltage was 25 Kev; the brass platform's beam current of 2×10^{-8} A was used as standard. Prior to the analysis, the specimens had been put to qualitative and semi-qualitative tests with a U.S.-made ORTEC 6200 x-ray multichannel energy spectrometer (see energy spectrum pictures of native ruthenium). Subsequently, an electronic probe was used to conduct quantitative analysis of the mineral composition; reflective electronic images, and secondary electronic images of the specimens as well as the characteristic x-ray images of the principal elements were photographed (Photographs 1-4). [not reproduced]

The specimens were all selected from metallic elements with pure spectrums. The test results were corrected through ZAF, and the results of both analyses are shown in Table 1.

Table 1. Results of the Electronic Probe Quantitative Analyses of Native Ruthenium from Guangdong's Yangchun

	Ru	W	Co	Fe	Total
1*	100.0	--	--	--	100.0
2	91.10	6.07	2.44	0.74	100.35

*Determined by Chen Zhenyu [7115 2182 3842] of the Guilin Research Institute of Metallurgical Geology

Based on the results of the second electronic probe analysis, we have arrived at the following chemical formula:



The preceding native ruthenium chemical formula may be simplified to Ru.

X-Ray Powder Data

The Debye powder pictures of native ruthenium crystalline particles were photographed in the X-ray Lab of Wuhan Geological College with a Weissenberg camera (57.3 mm diameter), using the symmetrical method. Lab conditions: $\text{CuK}\alpha$, 35 Kev, 70-80 mA, exposure 6 hours. As the crystalline particles were tiny, plus the tendency towards preferential orientation, the photographs showed fiber characteristics, and the powder spectral lines were not continuous. Using the d-scale in measurements, the powder data were thus obtained and tabulated as shown in Table 2.

The special lines in the actual data matched completely with those in the ASTM cards (6-0663) for artificial Ru, and, as far as the structure was concerned, there was no doubt that the mineral in question was indeed native ruthenium. Based on diffraction lines (103), (112), (203) and (211), the sizes of the crystalline cells were measured as follows:

$a_0 = 2.72 \text{ \AA}$, $c_0 = 4.282 \text{ \AA}$, hexagonal crystalline system. The space group was $D_6^h = P6/\text{mmc}$.

Discussion

1. The native ruthenium found in our country exists in the form of monomer crystalline particles; its occurrence is clearcut; its nomenclature

Table 2. X-ray Powder Diffraction Data for Native Ruthenium of Yangchun, Guangdong

	l	θ	d	hkl
1	2	19.07	2.36	100
2	3	19.67	(2.29)	101(β)
3	3	21.11	2.14	002
4	10	22.02	2.06	101
5	4	28.79	1.59	102
6	5	34.53	1.354	110
7	4	39.19	1.225	103
8	3	42.14	1.150	112
9	2	43.01	1.130	201
10	2	45.22	1.086	004
11	3	58.30	0.906	203
12	3	62.13	0.872	211
13	3	65.66	0.846	114

Analyst: Ma Zhesheng [7456 0811 3932] and Ximen Loulou [6007 7216 7216], X-ray Lab, Wuhan Geological College

is based on its composition, optical properties and x-ray data; and it is thus classified as the end member of the ternary Os-Ir-Ru system.

2. The crystalline cell parameters of native ruthenium are as follows:

$a_0 = 2.72\text{\AA}$, $c_0 = 4.282\text{\AA}$. Compared to the size of artificial Ru crystalline cells ($a_0 = 2.7058\text{\AA}$, $c_0 = 4.2819\text{\AA}$, its a_0 volume is slightly greater than artificial Ru, which could be related to its small contents of W (electronic probing analysis showed $W = 6.07\%$), since the radius of a W atom is slightly greater than Ru.

3. In 1974, a ruthenium-rich mineral from Horokanai, Hokkaido was discovered in rutheniridosmium (electronic probing analysis data: Ru 64.43 percent; Ir 14.62 percent; Os 5.29 percent; Rh 7.05 percent; Pt 9.14 percent). Based on the nomenclature principle of the ternary Os-Ir-Ru system proposed by Harris and Cabril¹ in 1973, Urashima and associates named it native ruthenium, and published a paper on the new mineral.² But as they could not conduct powder analysis, their report did not contain any x-ray data. Besides, the secondary electronic image did not reveal any distinct boundary between this kind of mineral and rutheniridosmium; thus, there were no clear indications as to the morphological feature of this particular kind of mineral or the relationship between it and rutheniridosmium. The discovery of native ruthenium in our country is further proof of the existence of native ruthenium in the natural world.

4. The main difference between the native ruthenium found in our country and the native ruthenium produced in Hokkaido, Japan lies in their chemical compositions. China's native ruthenium contains 91.1 percent Ru; its composition is relatively pure, and it does not contain other platinum group elements. Its Ru content is almost 30 percent higher than the native ruthenium of Hokkaido, Japan (Ru 64.4 percent).

5. At present, this type of mineral has been found only in concentrates of samples from oxidized zones. So far, it has not been found in any new augites which are its protogenic rocks. This could be attributed to the relatively low Ru content in the protogenic minerals, plus the extremely small size of the mineral particles which makes enrichment difficult. Moreover, it is impossible to observe its intergrowth composition with other minerals. Further mineralogical research must be conducted to learn more about its genetic relations.

The authors express their thanks to the 704 Team Laboratory of the Guangdong Geological Bureau, the X-ray Lab of Wuhan Geological College, and Chen Dianfen of the Chinese Academy of Geological Sciences for their help, and to Messrs Peng Zhisheng and Chen Zheng [7115 2973] for checking the completed manuscript and giving advices.

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9119

C50: 4006

APPLIED SCIENCES

NEW CHINESE CHARACTER INPUT SCHEME DEVELOPED

Tianjin TIANJIN REBAO in Chinese 11 Jun 80 p 1

[Article: "Encoding Based on Shape and Sound of Characters Is Easy To Remember and Promote, and Will Help Spread the Use of Computers in all Areas of Chinese Life"]

[Text] In order to enable Chinese characters to be processed by computers, Guo Shuzhen [6753 3219 3791] of the Institute of Data and Communications Technology of the Ministry of Posts and Telecommunications, Yang Junlin [2799 0913 2651] of the Information Office of the Tianjin Municipal Scientific and Technical Committee, and Guo Jingui [6753 3160 4428] and Wu Hui [0502 6540] of the Tianjin Municipal Postal Institute have cooperated in developing the UYBX Combined Sound-Shape Encoding Scheme for processing Chinese characters. From 6 June to 9 June, the Bureau of Science and Technology of the Ministry of Posts and Telecommunications, the Tianjin Municipal Scientific and Technical Committee, and the Scientific Research Institute of the Ministry of Posts and Telecommunications joined in holding an appraisal meeting in Beijing. More than 80 representatives from more than 50 organizations, including the Computing Center of the State Planning Commission, the Institute of Computer Technology of the Chinese Academy of Sciences, Institute of Linguistics of the Chinese Academy of Social Sciences, and the Chinese Communications Society attended the meeting. The delegates felt that the proposal was fairly good, that it possessed many outstanding features, was a gratifying achievement, could be applied in many sectors and could be continuously improved.

The scheme underwent testing and trial use by the Computing Center of the State Planning Commission, the Computing Center of the Ministry of Metallurgical Industry, a certain research institute of the Second Artillery, and the 7th Research Institute of the Ministry of Posts and Telecommunications, which confirmed that it was suitable for computer input of Chinese characters and could be used for telegraphic communications.

The scheme possesses a rather high degree of regularity. It has short codes and is fast, so that when one sees the code the character is apparent. It is easy to remember and has other good features which are conducive to promoting its use.

If we are to develop the application of computers in various sectors in China, it is necessary to solve the problem of character information processing, of which the first step is to change the characters into a code which the computer can recognize. Chinese linguists and computer research personnel in China have expended considerable effort and proposed numerous hypotheses and proposals for putting Chinese characters into computers. Through several years of arduous research, comrades Guo Shuzhen, Yang Jianlin, Guo Jinglu, and Wu Hui arrived at the UYBX encoding scheme. This proposal attracted the serious attention of concerned departments as soon as it was formulated. Last May the computing center of the Ministry of Metallurgical Industry began to use this system on a trial basis, carrying out line point-to-point communications experiments with the Tianjin Bureau of Metallurgy. Before long, a certain research institute of the PLA Second Artillery adopted the scheme and carried out on-line testing of the character information processing system, including character input, display, printing, internal code conversion, character editing, character retrieval and other functions, achieving fine results. The Information Office of the Tianjin Municipal Scientific and Technical Committee had fine results in using this system to experiment with payroll processing on microprocessors and in retrieving the results of scientific research. The State Planning Commission is already using this system on a trial basis in the communication networks in 26 provinces and municipalities throughout the country to carry out normal communication work. Having undergone rather widespread experimentation and application by different departments, the system was very well received by the testing units and operational personnel.

CSG: LCMR

MODERN CIPHER MODERN COMMUNICATIONS DESCRIBED

Shanghai KEXUE HUABAO [SCIENCE PICTORIAL] in Chinese No 8, Aug 79 pp 12-13

[Article by Shao Yabao [6730 0068 1405]]

[Trans] In the article "One Time Ciphers and Successive Encryption," we provided a preliminary introduction to successive encryption, but this is only the foundation of modern cryptology, using addition and subtraction to encipher characters and symbols. In modern communications, besides the transmission of the written word in messages, there are also speech and pictures, therefore, the mathematical tools used by modern cryptology in the encryption of modern communications are very complex, using everything from matrix algebra to number theory.

Encryption by Groups

The method of successive encryption is transforming characters into numbers and then encrypting them. Encryption by group does not encrypt numbers again individually, but transforms the section of clear text (that is characters) into a group of encrypted text according to fixed rules.

Taking the commonly used matrix encryption method as an example, we could take the 26 letters of the English alphabet and arrange them at will into a matrix cipher key according to the 5×5 matrix shown in Figure 1-a. Inasmuch as it only contains $5 \times 5 = 25$ letters, we will specify that T will be substituted for I, O will be substituted for spaces between words, and carry out substitution encryption of the letters according to the following rules:

1. Divide the clear text into a number of groups by forming a group from every two letters from beginning to end.
2. If the two letters in a group are in the same row, the letters to the right of the respective letters will be substituted for them, such as substituting VU for WD. When the last letter in a row is encountered, the first letter in that row will be substituted, such as substituting RC for NC.

H	S	K	F	X
Q	A	B	M	J
G	T	N	R	C
Y	L	E	Z	P
D	W	V	O	U

a

Y	J	Q	V	E
B	L	F	S	M
O	X	A	T	C
N	Z	H	G	P
R	U	D	K	W

b

Figure 1.

3. When the two letters are in the same column, the respective letters below them will be substituted for them, with the bottommost letter in a column having the topmost letter substituted for it, such as RO being substituted for MZ, and PX being substituted for CU.

4. Where letters are repeated, the letter below it in the column would be substituted for it, such as substituting UU for PP.

5. When the two letters in a group are on a diagonal in the matrix, the two letters in positions symmetrical to them on the other diagonal would be substituted for them, such as substituting XM, for HA.

After adopting such rules for encryption, we could encrypt the clear text Happy New Year to you. First, every two letters of the clear text would be placed in a group, making: HA PP YO NE WD YE AR OT OO YO UO; and then converting it according to the rules mentioned above into the encrypted text arrangement: /XM/UU/.. /EV/VU/LZ/... /FP/.. /DU/. The entire clear text cannot be converted into encrypted text by using the matrix cipher key in Figure 1-a, however, because four groups--YO, AR, OT, AND YO--are not in the same row, the same column, nor on a diagonal; so there is no way in which they could be converted according to the rules. They are represented by ".." in the above encrypted test sequence. Yet we could make another matrix cipher key in advance (Figure 1-b). In this way we could convert the above four groups of letters into encrypted text according to the rules. From this we can see that a series of matrix cipher keys could be made so that the entire clear text could be converted into encrypted text. Finally, we would derive the following encrypted text: XM UU BN EV VU LZ AW XC PF BN DU. Were a third party to intercept such a secure telegram, he could not even guess its meaning.

The reliability of encryption by groups lies principally in the length of the groups and the selection of the method of substitution. In the above example, we only did it with groups of two, whereas were we to use comparatively longer groups (such as four letters to a group) or alternate lengths of groups (such as three letters in a group, five letters in a group, and again three letters and five letters in a group), the reliability after encryption would be raised further yet. In addition, were more matrix

cipher keys to be developed, the above English clear text sentence would show even more of "A totally false countenance."

The Design of Cryptic Language

Successive encryption and decryption by groups is suitable for the encryption of written messages. Technically, the transmission of images may be handled as written messages are. In modern communications, besides the transmission of messages in the form of letters and images, there is also speech. How is the encryption of speech conducted? Speech is a type of audio frequency analog signal, and there are three commonly used methods of encrypting this type of analog signal:

Voice Concealment. This is a method of directly encrypting analog voice signals. On the left side of Figure 2 is shown the wave form of voice signals before encryption. We divide these signals into 18 sections according to frequency, with the corresponding amplitude value of the center of each section (shown in the figure by black dots) used to represent the amplitude of that frequency section. Then the various sections are exchanged according to prearranged rules to mix up the original arrangement. This is depicted in the figure as rearranging the numbers of the various frequency sections along with their corresponding black dots, finally deriving the wave form shown on the right side of Figure 2, which can be seen to bear no resemblance to the original wave form. After being exchanged at will, the voice signals become "cryptic language"--a string of disorderly strange sounds which cannot be understood at all by a surreptitious listener. To restore the original signals, the receiving party need only rearrange the amplitude values corresponding to the various frequency sections according to the rules agreed upon in advance.

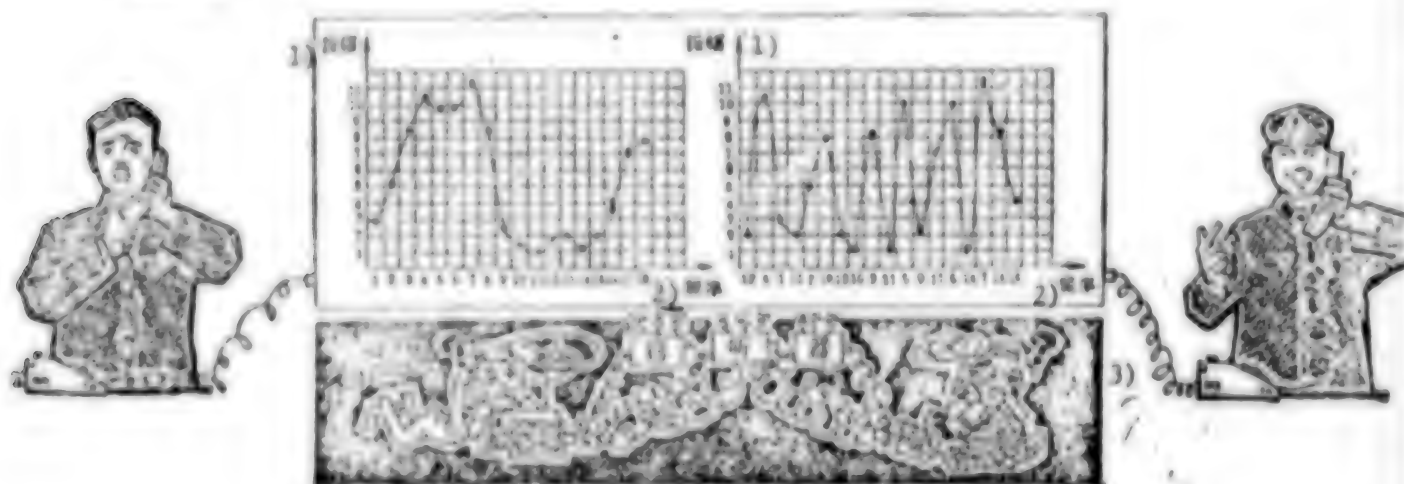


Figure 2.

- Key: 1) (vertical axis) amplitude
 2) (horizontal axis) frequency
 3) Surreptitious listening (monitoring) equipment

The level of security provided by this type of cryptic language is determined principally by the selection of the exchange method. Because of the inherent limitations of exchange methods, a high level of reliability cannot be achieved by this type of encryption method. Should the surreptitious listener record the cryptic language and use electronic computers to carry out program analysis, it would still be possible to break this type of cryptic language.

A trend in the modernization of communications technology is first to digitize the message to be transmitted and then to transmit it digitally. In the field of voice encryption technology this produced digital voice encryption.

Digitized Voice Encryption. Modern digital telephony is a communications technique in which voice signals are transmitted digitally after having been digitized (Reference "Digital Communications" in the April 1978 issue of this periodical). Such analog signals which have already been digitized may be encrypted according to the encryption method used for encrypting characters. Transmission, reception, and reconversion of voice signals after digitizing and encrypting them greatly increases the intermediate technical links. To enable the distant party to hear the sound on a timely basis requires the very high speed transmission of digital pulse signals, generally transmitting at a minimum of 15,000 binary pulse signals per second. The general run of public telephone circuits cannot accept such high rates of transmission. To permit the transmission of digitized voice signals over ordinary telephone circuits, people invented the sound encoder method.

Sound Encoder Method. Its fundamental theory is similar to that of speech digitizing. The difference is that the sound encoder method encrypts and transmits only the principal spectrum component (rather than the entire spectrum component) of the voice signal, and this is done under the premise of insuring that it [the signal] does not become deformed.

The distinction between these two methods resembles somewhat that between outlining (Figure 3, right side) and sketching (Figure 3, left side). A good artist needs only a few strokes to draw a person remarkably true to life. The voice encoder is thus the "stenographer" who sketches the voice signals.



[Best reproduction available]

Inasmuch as the voice encoder grasps the critical characteristics of the voice signal for digitization, the number of digital pulse codes is reduced greatly, lowering transmission speed requirements. This type of encrypted voice signal may be transmitted on better-quality public telephone switching networks.

New Developments in Cryptology

Along with the development of modern communications, the scope of application of cryptography has continued to expand, and cryptologic methods are becoming more and more marvelous. With the entry of the computer into the field of communications, the question of encrypting computer communications has naturally risen. Data transmission between computers is an arrangement of a continuous series of "0's" and "1's." This can also be encrypted by the successive encryption method, except that base-10 calculations must be converted to the binary principle. Because there are only two symbols: 0 and 1, when developing new cipher keys, the probability of repetition using the previously utilized cipher keys is much greater. Therefore specialized cipher key generators for transmission and reception must be used to lengthen the cyclic period of the cipher key arrangement as much as possible.

In their research in cryptographic methods, people have always thought about whether a type of cryptosystem could be developed which, by being able to use computers for high-speed encryption and decryption, could be used repeatedly without changing the cipher key, and would not be broken by cryptographic specialists. [Lifesite 0441 1715 2448 3676] and others of the Massachusetts Institute of Technology in the United States proposed to begin with number theory research and use prime numbers as a "trap door function" to develop cryptographic systems. This brilliant hypothesis established a type of cryptographic system which would be difficult to break in a thousand years, while the method of encryption could be completely open. This was definitely a major breakthrough in cryptology.

8174

CSO: 4908

ASPECTS OF SHIP DESIGN ANALYZED

Beijing CHUANBO GAILUN [INTRODUCTION TO SHIPS AND VESSELS] in Chinese
29 Mar 79 pp 57-62, 101-102 and 199-201

[Extracts from book edited by Wuhan Water Transport Engineering Institute; sections renumbered]

[Text] 1. Speed Characteristics

As everyone knows, in order to make a ship sail at a given speed, it is necessary to assure that the propeller will produce a certain amount of thrust to overcome drag. In order to assure that the propeller will develop the proper thrust, the main engine must provide the propeller with a certain amount of power. It can be seen that the hull, the propeller and the main engine are interrelated.

The ship's speed characteristic is the ability of the main engine to achieve a relatively high speed with a relatively small power consumption.



Figure 3-14

Key:

- | | |
|-------------------|-----------------------|
| 1. Speed v | 4. Pump room |
| 2. Resistance R | 5. Oil hold |
| 3. Engine room | 6. Miscellaneous hold |

If we let the ship's speed be v (meters per second), with a drag R (Figure 3-14), then the power consumption (in a unit time) is $R \times v$, which is called the effective power. Power is usually measured in horsepower. Since 1 horsepower is 75 kilogrammeters per second, the (metric) effective power is

$$P_E = \frac{R \times v}{75} \quad \text{马力} \quad (3-9)$$

The energy required to propel the boat forward is provided by the main engine, and the power which the main engine develops is called the engine power P_M . The power produced by the engine is transmitted to the propeller through a reduction gear, the thrust bearing and the propeller shaft, after which the rotation of the propeller imparts to the ship the power to move it forward, which is called the propulsive power. The propulsive power is generally smaller than the power developed by the main engine, because the power developed by the main engine suffers some losses in the transmission and conversion process. At a given speed the propulsive power produced by the propeller is used in overcoming the corresponding effective power; they are numerically equal.

The ratio of a ship's effective power to its engine power is called the propulsion efficiency and is represented by η :

$$\eta = \frac{P_E}{P_M} \quad (3-10)$$

Combining equations (3-9) and (3-10) we obtain

$$P_M = \frac{P_E}{\eta} = \frac{R \times v}{75 \times \eta} \quad \text{马力} \quad (3-11)$$

Equation (3-11) gives the relationship between the engine power P_M and the drag R , the velocity v and the propulsion efficiency η . To maintain a certain speed v , while minimizing engine power P_M , the most effective methods are: first to decrease the drag R ; and second to increase the propulsion efficiency η . These two problems are the ones which must be solved in relation to the speed characteristic.

A. Decreasing the Drag

When a surface vessel moves through still water, it is subject to air and water resistance. The resistance of air above the ship's water line is called "air resistance," and in most civilian ships it amounts to only 2-4 percent of total resistance. The resistance of the water below the water line is called "water resistance," and includes two parts: the appendage resistance of rudders, shaft brackets and bilge keels protruding from the hull, and the resistance of the hull itself, or "naked hull resistance." Under ordinary conditions the appendage resistance is only 3-10 percent of the total drag, and accordingly the naked hull resistance is the main component of the drag on a ship. Accordingly decreasing ship drag primarily involves a decrease in naked hull resistance.

In Figure 3-15 a hull model moving in still water in a tank is shown. By observing closely we can see that unusual phenomena are produced at several points around the hull.



Figure 3-15

First, because water is a viscous fluid, a thin layer of water adheres to the hull in a longitudinal direction as soon as it begins to move forward; in marine architecture this is called the "boundary layer." For ease in observing it, we show it in magnified form in Figure 3-16. When the ship and the boundary layer move forward, energy is consumed and frictional drag produced; the size depends on the wetted surface area of the hull. In addition, it is also related to the speed, the roughness of the hull and other factors. Barnacles and seaweed in the water generally grow on the hull, making it very rough and thus increasing the frictional drag; this is generally called "bottom fouling drag." It is particularly great when a ship is sailing in equatorial regions. When a ship frequently sails between seawater and fresh water, this fouling is somewhat alleviated. In order to decrease the effect of fouling, most seagoing ships go into dock at regular intervals for removal of the fouling and repainting of the hull, which increases the sailing speed.

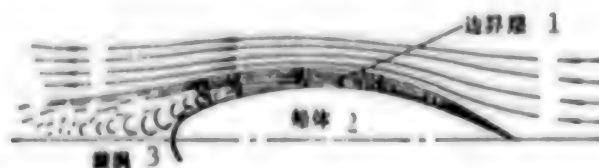


Figure 3-16

Key: 1. Boundary layer 2. Hull 3. Eddies

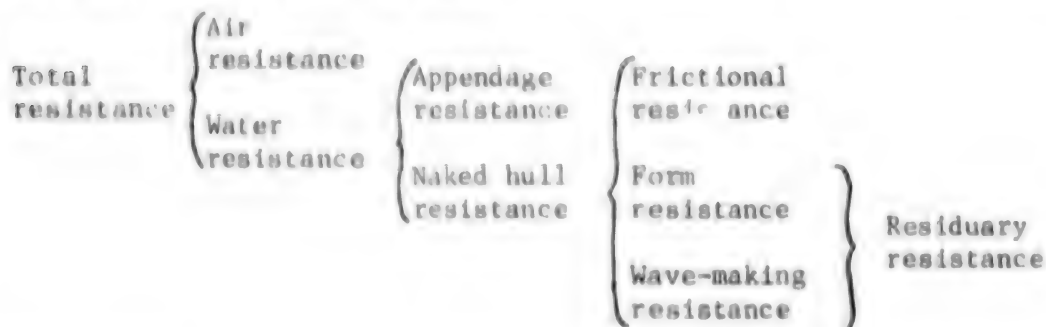
Second, eddy currents are produced at the stern of broad ships (see Figure 3-16). These are forced astern of the ship and are continuously produced. The eddies consume energy equivalent to the resistance encountered by the hull, and this is called "eddy resistance" or "form resistance."

Third, waves are produced around the ship; and this energy loss is called "wave-making resistance."

The total resistance experienced by a ship is primarily naked hull resistance, which is a combination of the abovementioned three resistance factors. When sailing at low speed, frictional resistance is the main component, sometimes amounting to 75 percent of total resistance. Eddy

resistance and wave-making resistance only amount to 25 percent, and are called "residuary resistance." But when the ship is sailing at high speed, frictional resistance accounts for a smaller percentage, and residuary resistance may be 60 percent or more.

Categorizing the foregoing, the drag experienced by a surface ship sailing in still water is as follows:



Frictional resistance is primarily affected by the size of the ship and the surface roughness and is not much affected by shape, so that methods of decreasing this kind of drag are extremely limited. One effective method is that of improving the paint characteristics. In order to decrease friction drag on submarines, some people have studied the viscous substances secreted by fish skin in order to develop a paint with good lubricant capabilities, but this has not yet been successful. Accordingly, for many years the main approach has been to change the shape of the hull in order to decrease residuary resistance, and noteworthy results have been obtained. The glide boats, hydrofoils, and air cushion ships are successful ship designs which decrease wave-making resistance. The initial purposes of designing double-hulled ships were that of increasing stability, and especially that of obtaining decreased wave-making resistance, but this attempt has had only partial success. The wave-suppressing shape currently used on some river ships has good wave-decreasing properties and has relatively low resistance at medium and high speeds. Figure 3-17 shows a wave-suppressing ship body plan. The short range passenger and cargo boat Dongfanghong No 118, developed for the upper Yangtze in 1971, also uses a longitudinal-flow wave suppressing shape, and practical experience with it shows that its wave decreasing and handling characteristics are relatively good, but the bow is relatively subject to wave impact. Because these ship designs have low-speed drag characteristics which are inferior to ordinary ship designs, and also because in high winds and heavy seas wave impact and pitching are relatively serious, in recent years these ships have been slow to gain acceptance and opinions of them have been mixed; more investigations and model tests are needed to demonstrate their value.

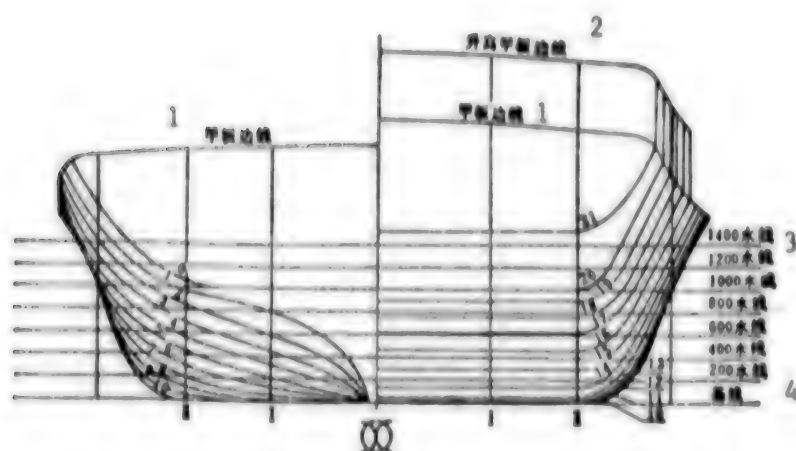


Figure 3-17. Transverse section of wave-suppressing hull

Key: 1. Deck line 3. Water line
2. Raised deck line 4. Base line

In our discussion of measures to decrease ship drag, we should also mention the effect of the bulbous bow. In reality the bulbous bow involves adding a rounded body to the bow of an ordinary ship. When sailing, both the hull and the bulbous bow produce a wave train. But if designed correctly, they can make the wave peaks of certain waves coincide with another series of troughs so that they interfere with each other and cancel each other out, thus decreasing wave-making resistance.

Research on bulbous bows began early in this century, but it was limited to military and high-speed ship applications; in recent years, however, it has been extended to tankers and bulk cargo ships. For example, the ocean-going dry cargo ship Fengguang [7364 0342], the oil tanker Daqing [2192 1987] No 40 and the 25,000 ton bulk cargo ship Zhengzhou [6774 1558] all have bulbous bows.

In the process of development of bulbous-bow ships, many different designs (shown in Figure 3-18) have appeared.

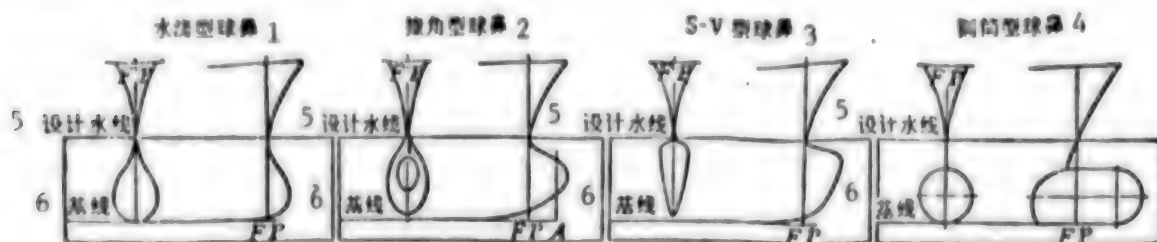


Figure 3-18. Several types of bulbous bow

Key:
1. Drop shape 3. S-V shape 5. Design water line
2. Impact angle shape 4. Rounded cylinder shape 6. Base line

1. Drop-shaped bow. This is a form which was adopted rather early. When viewed head-on the underwater part looks like a hanging drop, hence the name. This is the first of the designs shown in Figure 3-18. A characteristic of this shape is that the bottom part is almost level with the keel, and the effects are best when it is fully loaded. But when ballasted and in high winds and heavy seas, the bulbous bow is subject to wave impact, and its effectiveness is almost lost. It is best used in high-speed regular cargo ships.

2. Impact-angle bow. The bow of the ship has a protruding, acute-angled rounded tip. The pointed tip is approximately flush with the ballast line, so that when sailing with ballast the effects are very good, but when fully loaded they are less good. This type of prow is usable in broad oil tankers, ore ships and bulk cargo ships, because with these ships a ballasted return voyage is almost unavoidable. This type of design is also quite poor in heavy winds and high seas.

3. S-V shaped bow. Seen from the side, the bow is S-shaped, but when viewed from the front it is V-shaped, hence the name. This type of bulbous bow is effective when fully loaded, and is also fair when ballasted. In addition, in wind and heavy seas, the head-on impact of waves is relatively light. Accordingly, this shape is rather extensively used. The Zhengzhou has this type of bow.

4. Rounded cylinder shape. This is a cylinder attached to the nose of an ordinary ship design. The cylinder ends in a hemisphere, and the length of the cylinder depends on the breadth of the ship and the speed. Experiments show that this type of bow decreases resistance both when fully loaded and when ballasted. Because of its simple structure, it is inexpensive to produce, and it is often added to older ships already in service.

In general, adding a bulbous bow can increase speed by about 0.5 knots. The bow also somewhat increases buoyancy, and can produce a slight increase in load carrying capacity over other ships of the same dimensions. For ships with the engine room aft, the bulbous bow can serve as a ballast tank, so as to adjust the trim of the ship. But some problems are also associated with ships. For example, when dropping anchor, the anchor may collide with the bow, and in addition raising the anchor is difficult. Moreover, ships with the bulbous bow also experience some difficulty in docking.

B. Increasing the Propulsion Coefficient

As mentioned above, in the process of transmitting power from the main engine to the propeller, there are power losses resulting from friction in the reduction gears, the thrust bearing and the like. Because of recent advances in the mechanical industry, these friction losses are now much smaller; the reduction gear efficiency has been increased to

0.94-0.99 and that of the propeller shaft to the same range. It is only the efficiency of the propeller that is low, generally amounting to 0.1-0.7. Accordingly, the problem of increasing the propulsion efficiency is really primarily a problem of increasing the efficiency of the propeller itself.

In order to investigate high-efficiency ship propellers, in the last hundred years, wheel-type propellers, hydraulic screw propellers, aerodynamic propellers and jet propellers have been tried out in practice. Because hydraulic screw propellers have a simple structure and high efficiency, they are the most extensively used.

In the use of hydraulic screw propellers, variants such as ducted propellers, vertical axis propellers and 360° turnable propellers have appeared.

1. Ducted propellers. Ducted propellers are also called shrouded propellers. Their structural peculiarity is that around the screw is installed a cylindrical sleeve with an airfoil-shaped longitudinal section which is called a duct or shroud. If the shroud and hull are a single unit, this is called a rigid shroud; if the shroud is connected to a rotating rudder and also functions as a rudder blade, it is called a movable shroud. Figure 3-19 shows the movable guide tube propeller on the Changjiang [7022 3068] No 440 tug.



Figure 3-19. Shrouded propeller

The reasons that the shrouded propeller can increase efficiency are that: (1) the flow speed within the guide tube is high and the pressure low, and the pressure difference between the interior and exterior of the guide tube produces an additional thrust on the wall of the shroud; (2) because the gap between the propeller blades and the shroud is very small, this limits bypass losses at the ends of the blade tips; (3) the shroud can decrease wake compression behind the propeller, which means that energy losses are decreased. Experience shows that for ships with relatively high propeller loading, such as tugs and pusher tugs, the use of the propeller shroud produces particularly good effects. If correctly designed,

It can increase the power at the towing hook by 10-15 percent. But for propellers with light loading the shroud produces only a small effect.



Figure 3-20. Vertical axis propeller

Key: a. Boat with vertical axis propeller
b. Structure of vertical axis propeller

2. Vertical-axis propellers. Figure 3-20 shows a harbor ship equipped with a vertical-axis propeller. The characteristic of this propeller is that the axis of rotation and the propeller blades are both vertical, and when in operation the propeller rotates in a horizontal plane, hence the name. It is necessary only to feather the blades in order to direct the thrust of the propeller forward, backward, to the right or to the left. It is not necessary to reverse the main engine; even more important, because the thrust can be directed in any direction, maneuverability is particularly high, and it is particularly suited to harbor boats whose mobility requirements are extreme. Because the structure is very complex, the production cost is high, and accordingly this type of propeller has come into only limited use.

3. Turnable 360° propeller. The characteristic of this propeller is that the screw can be turned through 360° (in the horizontal plane). Figure 3-21 shows a 360° propeller with shroud; the power train is shown in Figure 3-20 [not reproduced].



Figure 3-21
Turnable 360°
propeller

For maneuverability to the right or left, front or back when the boat is in motion, the 360° propeller is even better than the shrouded propeller and the vertical-axis propeller. This is because although the shrouded propeller produces considerable thrust when moving forward, the thrust is lessened when backing, and maneuverability is less than ideal. Conversely, the vertical-axis propeller has good maneuverability, but thrust and thrust efficiency are lower. Even though the 360° propeller has no rudder, it can still turn all of the propeller thrust in a manner equivalent to that of a rudder, so as to maneuver the ship;

In addition the thrust per unit power is high, and moreover the backing thrust is the same as the forward thrust so that a change from forward motion to backing is quite rapid, and affords convenience of maneuverability for the pilot. Accordingly, this new type of propeller is suited for tugboats. Its disadvantage is the complexity of the mechanism, which can easily be damaged by floating wood or other objects.

4. Jet propeller. This is a hydraulic reaction propeller which consists of a hydraulic pump apparatus inside the ship and a water intake and jet tube. The jet opening can be submerged, out of water or semisubmerged. The jet propeller has a simple structure and is reliable in operation, and it eliminates the danger of damage to propeller blades from striking floating objects. It eliminates the vibration at the stern of the ship produced by propellers. In addition the jet propeller can allow the machinery to be maintained at a fixed rotation speed, with the ship's speed altered by changing the pump or jet orifice area, in addition to which changes in the direction of the jet can be used for turning and backing. It also decreases machine noise produced by propellers. In addition, jet propeller installations are installed inside the ship, which makes for ease of servicing and maintenance and decreases operating costs. Figure 3-22 shows a jet propulsion apparatus installed on a hydrofoil.

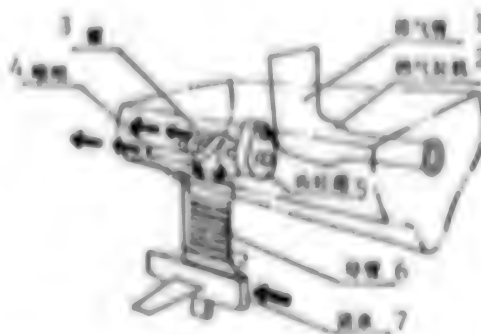


Figure 3-22. Jet propeller

Key:

- 1. Exhaust
- 2. Gas turbine
- 3. Pump

- 4. Jet orifice
- 5. Gearbox
- 6. Guide tubes
- 7. Direction of water flow

In recent years, this country has developed a jet-propeller high-speed gliding boat with a dual pitch axial flow pump. The boat can reach 30 knots or more. Experience shows that performance is excellent and some technical performance characteristics exceed those of domestic and foreign products of the same type.

As science has progressed, recently a 360° jet propulsion unit has also appeared. This propulsion unit was developed from a 360° screw propeller.

It has all the advantages of the 160° screw propeller, but its depth of immersion is only 25-30 cm, the thrust-to-power ratio is 12-17 kg/hp, and it is suitable for small river or shallow-water boats and for bow-mounted auxiliary rudder installations on large pusher tug or cargo ships.

2. Nuclear Power Plants

The main component of the nuclear propulsion unit is the nuclear reactor, which is equivalent to the boiler and combustion chamber of a conventional installation. The nuclear fuel undergoes a chemical reaction within it and emits large quantities of heat. In order to use this heat energy, a liquid coolant can be cycled between the reactor and steam boiler, which both cools the reactor and transmits the heat energy to the steam unit, thereby producing large quantities of steam to drive the steam turbines.

Figure 5-6 gives a diagram of such an installation; the coolant is pressurized water at 100 atmospheres, so that it is called a pressurized water-cooled reactor. The nuclear power plant has a high power output and the ability to support a long stay at sea, and does not require combustion; but it is necessary to install secure radiation protection equipment to protect the health of the crew. Currently, many nuclear power plants are in use in military vessels and icebreakers, but there is not much trend toward using them in commercial fleets worldwide.

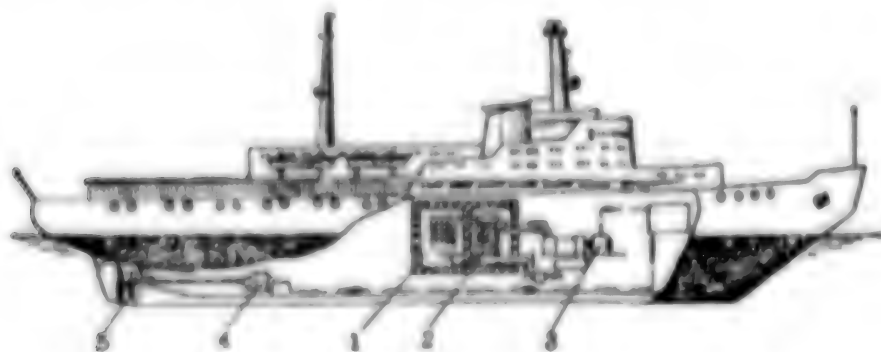


Figure 5-6. Nuclear power plant.

Key:

- | | |
|-------------------|-----------------------------|
| 1. Atomic reactor | 3. Steam turbine generator |
| 2. Heat exchanger | 4. Propeller electric motor |
| | 5. Propeller |

1. The Lines Plan, Laying Off, and Marking

A. Full-Scale Modeling and Marking

1. Lines plan and structural modeling of the hull. Full-scale modeling of the hull uses a special work area which has particular requirements: the lofting area. In the lofting area, the numerical values from the construction blueprints are used to draw a 1:1 scale line plan of the hull in three projections (body plan, sheer and half-breadth waterline diagram) on a painted floor. Afterwards the lines plan is revised and smoothed so that corresponding points in all the projections match up. In practice, in order to save area, the sheer and half-breadth plans are generally combined into one, as shown in Figure 7-1. After the lines plan has been revised and smoothed, diagrams of the ribbing are made in terms of the rib spacing and positioning. In addition it is necessary to add some line drawings that are needed but which cannot be shown in the blueprints (for example cross bearers, stem posts, shaft opening and the like).

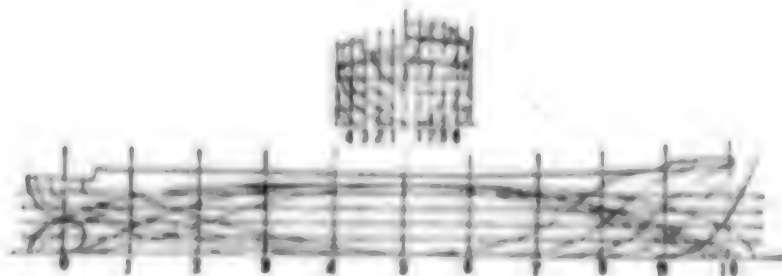


Figure 7-1. Ship lines plan

Next, using the standards for steel products and the relevant design blueprints, the layouts of all the structural elements including internal structural members, the crossing points of internal structural members and external plating and the junctions of external plating are laid out, after which the complete ribbing diagram is drawn.

2. Expansion of hull members. The hull structural members, with various spatial shapes (curves, twisting and the like) are "expanded" to determine their actual shapes and dimensions in flat form, so that it will be possible to mark out on flat plates and shaped sections, and finally to machine, the desired shapes.

Almost all of the methods which make direct use of the framing diagram to expand the structural members are geometric mapping methods. Some of the surfaces of hull structural members are expandable curved surfaces, i.e. can be expanded exactly to flat surfaces; other curved surfaces cannot be exactly expanded. For some of the parts which cannot be

exactly expanded as flat surfaces, approximate flat surfaces can be found by approximate geometric mapping methods so as to meet the accuracy requirements of shipbuilding techniques. For some of them the approximate methods have too great an error, so that it is necessary to make a three-dimensional model of them and then lay asphalt felt or tarpaper on them in order to work out their patterns from their actual shapes.

After expansion, the structural members should be assigned the necessary machining allowances according to the requirements of assembly and welding, after which templates or line drawings are made up for marking.

3. Template production and marking. Template production is the making of a certain number of patterns and templates (Figure 7-2a) or drawings (Figure 7-2b) on the basis of the requirements of marking, machining and assembly; for certain external plates of particularly complex curvature and the anchor pipes and recesses, among others, it is necessary to make three-dimensional models (Figure 7-2c). Templates, patterns and three-dimensional models are made up in accordance with the framing diagrams and the drawings of the expanded structural members.

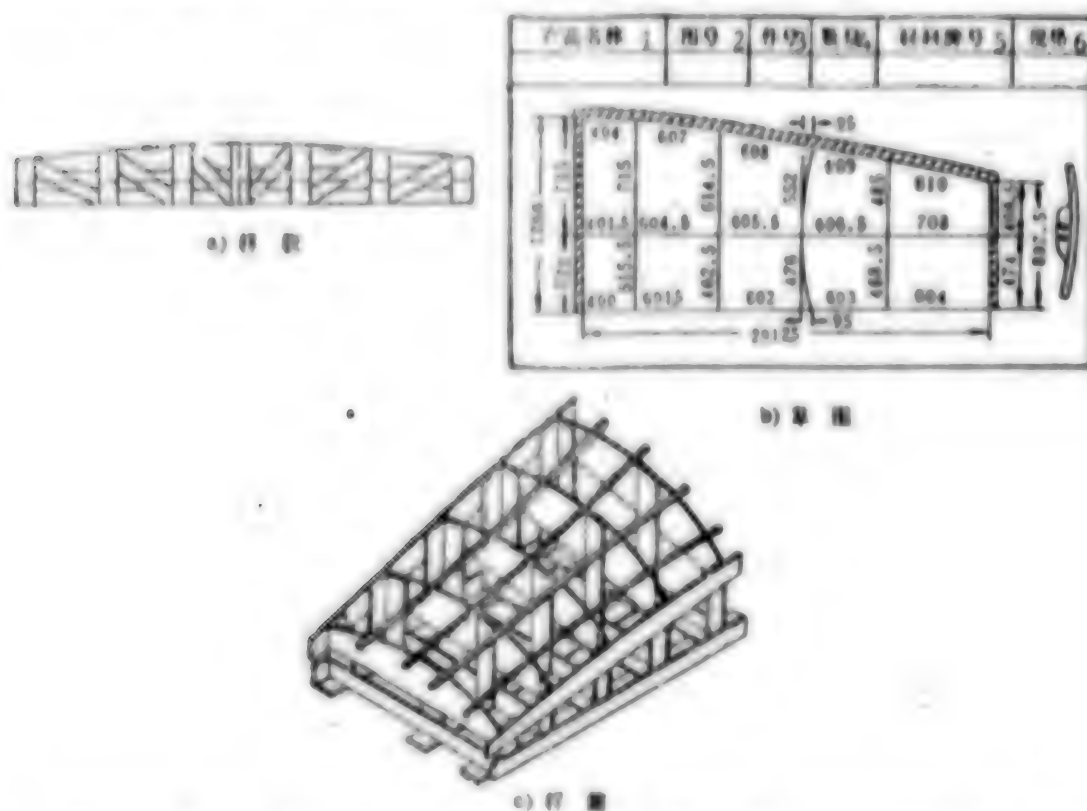


Figure 7-2. A template (a), drawing (b) and solid model (c)

Key:

- | | |
|----------------------|-----------------------|
| 1. Name of product | 4. Quantity |
| 2. Number of drawing | 5. Material trademark |
| 3. Number of part | 6. Standard |

In marking, the patterns, templates and drawings are used to mark on steel plates or sections the real shapes of the structural members expanded into flat form, after which they are numbered according to the name of the ship, the name of the part, the machining and assembly indications and the like. When marking it is important to conserve materials to the maximum extent possible. It should be noted that when straightening equipment and rust removal equipment are available, the steel products should be treated before marking.

The method of marking on steel plates or sections the true shapes of structural members after they have been developed in flat form on the basis of patterns and templates is called template marking. Marking by this method is convenient, but the making of the template requires large amounts of wood (or asphalt felt) and working time, and it is very inconvenient to store and transport the templates. Accordingly, in small-series and single-ship production, most of the hull members (such as flat decks, external plating, interior bottom plating, trusses and the like) are now marked from drawings. The marking methods described above are all based on manual operations.

B. Scale Layout and Optical Marking

In scale layout, the lines plan and structural layout are drawn up to 1:2 or 1:5 scale on a pattern table consisting of a small, flat, rigid aluminum plate (steel or plastic may also be used) painted with white nitrocellulose enamel, the hull members are expanded, and the pattern diagrams (for optical methods) or profile diagrams (for electrooptical tracking gas cutting machines) are made up. Because the scale template is smaller than full-scale ones, the precision must be greater, and the individual operations are finer.

Optical marking is a method in which a photographic negative (or a drawing on polyester material) of the pattern is placed in an optical projector on the marking stand, and the true shape of the structural member is projected, enlarged, on a steel plate (Figure 7-3) [not reproduced] and used for marking and entering the symbols.

The optical marking method is convenient for automating the marking process. For example, by using electrical printing or photosensitive marking combined with automatic transport and positioning equipment for the steel plates the marking process can be fully automated.

After repeated tests, this country's shipbuilders and technical personnel have experimentally developed automatic systems using electroprinting marking, optoelectric pattern marking and photosensitive marking, thus making a contribution to the automation of the ship hull marking process.

C. Mathematical Layout

The basic principle of mathematical layout is the use of mathematical formulas to express the lines plan of the hull (profile method) or the hull surface (curve approximation method). Figure 7-4 is a representation of the formula of the standard curve for the waterline in the drawing of a ship's hull; the dimensional data and the necessary boundary conditions are used as initial data, and iterative computer methods and calculations are used to revise and smooth the lines so as to obtain a hull lines plan which is smooth and in which the corresponding points in the various projections all match up. At this time every contour in the hull is expressed by a particular standard curve formula (profile method).

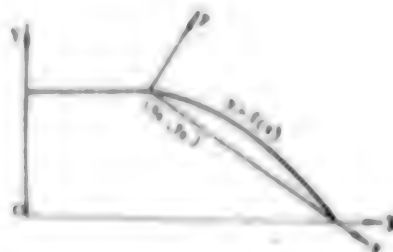


Figure 7-4. Method of representing a hull line in mathematical layout

The mathematical layout method can do the work of making the lines plan, the framing drawings and the plating junctions, can do the work of expanding the flat forms of the hull structural members, the framing parameters and dimensions of templates for machining, and can determine the control data for numerically controlled gas cutting and cold shaping of the ribs.

At present, mathematical layout is still in the development and improvement stage. On one hand, pattern display systems are being developed, so that in the process of making up the patterns by computer the designer can use a light pen to mark changes on the drawings; in addition, studies are under way on using mathematical methods for direct design of smooth hull contours called "mathematical hull shapes"; in the design stage it will be possible to use mathematical hull shapes to find the various hull construction parameters so as to eliminate the hull marking process.

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CSO: 4008

PERFORMANCE OF SLOTTED-NOZZLE DUAL-DUCTED PROPELLERS STUDIED

Wuxi ZHONGGUO ZAOCHUAN [SHIPBUILDING OF CHINA] in Chinese No 65, Apr 79
pp 1-33

[Article by Ye Yuanpei [0673 0337 1014] and Shen Yide [3088 6318 1795]:
"Experimental Studies of Dual-Ducted Propeller Series"; photographs not
reproduced]

[Excerpts] Abstract: In order to improve the efficiency of ducted propellers and to delay separation of the water flow from the trailing edge of the duct, the writers used the principle of wing flap lift to design a series of double-ducted propellers in which the rear duct was slotted and had an airfoil cross section. After preliminary experiments, the JD11 and SD11 double ducts with 15 different Holland towing tank Ka series propellers were used for open-water tests. On the basis of the experimental results, we analyzed the influence of several important parameters of the double ducts and propellers on open-water performance. In addition, we present open-water performance curves for the SD11+Ka duct and propeller combination, whose open-water efficiency was rather high, and present the regression polynomial and the graph of $\sqrt{B_p} \sim \delta$.

1. Introduction

Ducted propellers are becoming increasingly important in certain propeller systems intended to improve ship propulsion capabilities.

A ducted propeller is a composite propulsion unit consisting of a propeller and a cylindrical airfoil assembly called a duct. When it encloses the propeller, a duct can control waterflow in the vicinity of the propeller.

Flow ducts can in general be classified as accelerating and decelerating types. The former type accelerates the waterflow in the vicinity of the propeller, and a certain thrust is produced on the duct itself, which decreases the load on the propeller and increases its efficiency; the latter type causes the propeller blades to turn in a decelerating flow, producing a negative thrust on the duct and delaying cavitation.

The duct can be used to control the diameter of the propeller tail race, contracting it and reducing kinetic losses, or a turnable guide can be used to control the wake direction and thus to improve controllability. The duct can also be used in an axle-free symmetrical shape suited to the stern of the boat to produce a uniform flow of water ahead of the propeller so as better to utilize the wake and decrease vibration and cavitation.

Extensive practical experience with ducted propellers in the last 40 years indicates that when the propeller loading is large or when propeller diameter is limited, adding an accelerating duct is an effective way of increasing ship propulsion. It was long thought that ducted propellers were only suitable for boats such as tugs and trawlers. However, recently ship dimensions, speeds and engine power have been steadily increasing, which has accorded growing importance to efficiency of the propulsion unit and to problems of cavitation and vibration. It has considerably spurred the use and investigation of special propulsion units such as ducted propellers. In the last decade, ducted propellers have begun to be installed on some large tankers, freighters, destroyers, submarines, bathy scaphes, minesweepers, landing craft and even torpedoes, with excellent results. Table 1 lists some typical examples of recent uses.¹

Ideal propulsion theory indicates that ideal efficiency of a ducted propeller depends on propeller loading. In order to increase efficiency or decrease optimal diameter, it is necessary to further decrease the loading on the propeller within the duct, which in turn requires the use of an accelerating type high-lift duct section. Accordingly, even though it is possible to use an augmented airfoil section to increase the duct trailing edge diffusion coefficient (the ratio of the duct opening area to propeller disk area) or the tail diffusion angle, owing to the viscosity of the waterflow the arc of the duct section cannot be too great, otherwise the waterflow will separate from the inner wall of the duct and its trailing edge. If steps are taken to delay separation and further increase ducted propeller efficiency, the range of use can be expended in the direction of medium or light loading. The present article presents experimental results on some slotted trailing edge double-ducted propeller series which can delay separation and increase efficiency.

In aviation, the slotted flap is successfully used as a lift-increasing assembly, delaying separation of airflow from the wing surface.² On the basis of this principle, the authors designed a set of nine slotted-nozzle double propeller ducts (for simplicity called flap section ducts

Table 1. Some Foreign Ducted Propeller Assemblies

序号 a	船 型 及 船 名 b	吨 位 (吨) c	马 力 (匹) d	航 速 (节) e	轴 距 (米) f	轴 数 g	年 份 h	流 型 i
1	USS Witek*	3520	60000	35	2.8	2	1969	加速 j
2	USS Glover*	3020	30000	27	~4	1	1965	加速 k
3	Pyatidesyatletiy Komsomola*	8260	5200	16.2	~4.6	1	1968	加速 k
4	Ralph Misener*①	25000	9000	14	6.5	1	1969	加速 k
5	Kronoland*	131450	25000	16.7	8.3	1	1970	加速 k
6	Golar Nichu*①	215000	30000	16.6	9.4	1	1970	加速 k
7	U.S. Mark 48*	1.6	17000	50-60	<0.533	1	1971	加速 j
8	Thorsaga*	249750	34200 31500	16.8 15.3	9.0	1	1973	加速 k

Notes ① Turnable duct, adjustable-pitch propeller
 ② Adjustable pitch propeller
 ③ After trial cruise it was decided to equip three sister ships with ducted propellers

Key:

- a. Number
- b. Ship type and name
- c. Tonnage
- d. Horsepower
- e. Speed (knots)

- f. Duct diameter (meters)
- g. Number of propellers
- h. Year
- i. Type of duct flow
- j. Decelerating
- k. Accelerating

- 1. Destroyer USS Witek
- 2. Destroyer Escort USS Glover
- 3. Freighter Pyatidesyatletiy Komsomola
- 4. Loose cargo ship Ralph Misener
- 5. Oil tanker Kronoland
- 6. Oil tanker Golar Nichu
- 7. U.S. Mark 48 torpedo
- 8. Tanker Thorsaga

and designated JD). While maintaining the duct length-to-diameter ratio, maximum thickness ratio and leading edge contraction ratio unaltered ($L/D = 0.64$, $t/L = 0.12$, $\alpha_e = 1.34$), we let the trailing edge diffusion parameter take 3 values ($\beta_a = 1.20$, 1.25 and 1.30), and used 3 slot positions (ratio of flap secondary duct to total duct length $l'/L = 0.30$, 0.35 and 0.40), and by varying these 2 geometrical parameters of the flap cross section we tried to find the accelerating flap cross section duct which had the highest efficiency at medium and light loading.

In 1965, using A.M. Basin's method,³ we calculated design parameters for a simple ducted propeller on a certain ship ($L/D = 0.60$, $\alpha_e = 1.30$, $\beta_a = 1.15$). This duct is designated N_L . The propeller was a 4-bladed square-headed propeller with axially uniform pitch which was similar to the Holland towing tank K (Kaplan) type square-headed propeller, with

$A_E/A_0 = 0.88$, $P/D = 1.03$, and is designated K'4-88. In addition, making reference to C.F. Chen's method,⁴ we calculated parameters for a ducted propeller in which the duct was a dual-element type JD22 model (no account was taken of the effect of the slot) and used an English KCA 3-bladed broad-tip propeller with $A_E/A_0 = 0.95$ and $P/D = 1.154$, which was designated the KCA511.54. In both of these cases, the open-water tests gave efficiencies much lower than theoretical calculations. Then we used an existing model with mixed parameters for experiments, and we studied pairings of ducts with propellers. In the experiments we discovered that when the dual duct was combined with the K series propellers, satisfactory results were produced. Use of the K-type square-headed propeller with the JD11, JD21 and JD22 ducts gave the best results. Then we machined Ka series 4-bladed propellers with several disk area ratios, namely $A_E/A_0 = 0.70, 0.85$ and 1.00 , and with 5 pitch ratios $P/D = 0.6, 0.8, 1.0, 1.2$ and 1.4 , giving a total of 15 propellers, and carried out tests of these paired with the new SD11 and JD11 dual ducts.

2. Model Parameters

A. Duct Parameters

(1) JD Series Dual Ducts

The dual duct consists of a primary duct and a secondary duct; see Figure 4.



Figure 4. Section of dual duct

Key:

1. Main duct

2. Secondary duct

3. JD series

4. SD11

5. Secondary duct contour

The JD series is divided into three classes by the length of the main duct, and within each class the secondary duct has three different attack angles, making a total of nine ducts. The length-to-diameter ratios and maximum thickness ratios are all the same, and the maximum arch ratios are similar: $L/D = 0.64$, $t/L = 0.12$, $f/L = 0.05$. Other than in the

section where the slot is located, the internal and external walls of the three groups of main ducts have the same curvature. Within a group, the main ducts are the same, and only the secondary ducts' angles of attack differ; the position of the slot is the same, and the diffusion coefficients have three different values. This can be expressed in symbols thus: JDxy, where x is the group number and indicates the stage of variation of the slot position (or the length of the secondary duct). The y gives the sequential order of variation of the diffusion parameter (or of the angle of attack of the secondary duct). The total length of the duct is given by L and that of the main duct by l , while the length of the secondary duct is l' , and the axial length of the section in which the two ducts overlap is $0.05L$; after installation they all still formed a duct section whose inner wall was relatively smooth. The distance from the propeller disk surface to the leading edge of the duct was $0.40L$ in all cases. The main parameters of the nine ducts used in the prototypes are given in Table 2.

Table 2. Main Parameters of JD Series Double Ducts

No. 1	1. θ	2. l, l', α, β	第 一 组 2	第 二 组 3	第 三 组 4	前缘收缩系数 5	后缘扩散系数 6
1		主导管 $l = 0.75L$ 副导管 $l' = 0.30L$	$l = 0.70L$ $l' = 0.30L$	$l = 0.65L$ $l' = 0.30L$			
	$-2^{\circ}32'$		JD11	JD21	JD31	1.34	1.20
	0°		JD12	JD22	JD32	1.34	1.25
	$2^{\circ}32'$		JD13	JD23	JD33	1.34	1.30

Key:

- | | |
|------------------------------|---|
| 1. Secondary duct turn angle | 4. Third group |
| 2. First group | 5. Leading edge contraction coefficient |
| 3. Second group | 6. Trailing edge diffusion coefficient |

a. Main Duct Sectional Parameters and Positional Dimensions

(1) First Group (JD10)

Positional dimensions: radius of curvature of leading edge of main duct $R = 0.032l$
position of center of curvature of leading edge of main duct $X = 0.032l, Y = 0.168l$
center of curvature of leading edge of secondary duct $X = 0.9533l, Y = 0.1133l$.

Table 3. Main Duct Shape Parameters (JD10)

X/l %	0	3.33	5.00	7.50	10	15	20	25	30	40
Y_R/l %	16.80	20.00	.....	.....	.....	.....	.....	.....	.....	.....
Y_{R1}/l %	16.80	11.70	10.40	8.85	7.50	5.28	3.45	2.18	1.12	0
X/l %	60	66.67	70	75	80	85	90	95	97.5	100
Y_R/l %	.....	13.00	12.58	11.60	10.00	7.50	5.04	3.33	2.75	2.50
Y_{R1}/l %	0	0	0.04	0.10	0.33	0.67	1.17	1.84	2.17	2.50

(ii) Group 2 (JD20)

Positional dimensions: radius of curvature of leading edge of main duct $R = 0.343l$
center of curvature of leading edge of main duct $X = 0.343l$, $Y = 0.180l$
center of curvature of leading edge of secondary duct $X = 0.9536l$, $Y = 0.1221l$.

Table 4. Main Duct Shape Parameters (JD20)

X/l %	0	3.61	5.00	7.50	10	15	20	25	30	42.86
Y_R/l %	17.86	21.40	.....	.....	.....	.....	.....	.....	.....	.....
Y_{R1}/l %	17.86	12.34	11.23	9.58	8.20	6.00	4.38	2.98	1.79	0
X/l %	60	60	71.43	75	80	85	90	95	97.5	100
Y_R/l %	.....	.....	13.87	12.78	10.23	7.8	5.32	3.38	2.58	1.92
Y_{R1}/l %	0	0	0	0.02	0.16	0.38	0.78	1.25	1.58	1.92

(iii) Third Group (JD30)

Positional parameters: radius of curvature of leading edge of main duct $R = 0.0369l$
center of curvature of leading edge of main duct $X = 0.0369l$, $Y = 0.1938l$
center of curvature of leading edge of secondary duct $X = 0.9538l$, $Y = 0.1308l$.

Table 5. Main Duct Shape Parameters (JD30)

X/l %	0	5.0	7.00	10	15	20	25	30	35	40	45
$Y_{a/l}$ %	19.73	22.93	24.00	25.00	26.00	27.00	28.00	29.00	30.00	31.00	32.00
$Y_{b/l}$ %	19.73	19.91	19.78	19.56	19.37	19.22	19.06	18.91	18.76	18.61	18.46
X/l %	50	73.10	75	76.93	80	85	90	95	97.5	100	
$Y_{a/l}$ %	32.00	35.40	34.92	34.17	33.39	32.76	32.13	31.08	30.00	29.04	28.04
$Y_{b/l}$ %	0	0	0	0	0.08	0.15	0.43	0.69	0.85	1.04	1.04

b. Sectional Parameters of Secondary Duct

The cross sectional parameters of the secondary ducts in the three groups are similar.

Radius of curvature of leading edge of secondary duct $r_l = 0.05l'$.

Radius of curvature of trailing edge of secondary duct $r_t = 0.2 l'$.

Table 6. Secondary Duct Shape Parameters (JD Series)

x/l' %	0	2.5	5	10	15	20	30	40	50	60	70	80	90	95	98	100
y/l' %	1.00	1.00	1.20	1.50	1.70	1.90	2.00	2.10	2.20	2.30	2.40	2.50	2.60	2.70	2.80	2.90
z/l' %	0.00	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00

(2) The SD11 Dual Duct

a. Main Duct Sectional Parameters and Positional Dimensions

Total length of SD11 duct $L = 0.64D$, length of main duct $l = 0.75L$, length of secondary duct $l' = 0.30L$ (D is the propeller diameter).

Table 7. Main Duct Shape Parameters (SD10)

X/l %	0	5.33	5.00	7.50	10	15	20	25	30	35.5
$Y_{a/l}$ %	16.60	20.02	21.00	22.00	23.00	24.00	25.00	26.00	27.00	28.00
$Y_{b/l}$ %	16.60	11.44	10.00	8.35	7.00	5.92	5.28	4.65	4.01	3.37
X/l %	50	60	70	75.5	80	85	90	95	97.5	100
$Y_{a/l}$ %	28.00	31.47	31.00	30.00	29.00	28.00	27.00	26.00	25.00	24.00
$Y_{b/l}$ %	0	0	0	0	0.07	0.45	1.00	1.58	1.87	2.10

Proportional dimensions: radius of curvature of leading edge of main duct $R = 0.33t$
radius of curvature of trailing edge of main duct $r = 0.002t$
center of curvature of leading edge of main duct $X = 0.033t, Y = 0.1669t$
center of curvature of leading edge of secondary duct $X = 0.9533t, Y = 0.1133t$.

b. Sectional Parameters of Secondary Duct

radius of curvature of leading edge of secondary duct $r_L = 0.05 t'$
radius of curvature of trailing edge of secondary duct $r_T = 0.03 t'$
external airflow prismaticity of secondary duct $K = 2tg\Delta\alpha = 0.1398$ ($\Delta\alpha = 4^\circ$).

Table 8. Secondary Duct Shape Parameters (SD Series)

$c/l, \%$	0	5	10	15	20	30	40	50	60	97	100
$a/l, \%$	0.00	0	4	8	12	16	20	24	28	6.32	9.37
$ya/l, \%$	0.00	12.63	16.43	19.77	20.30	21.73	21.73	20.80	19.73	12.40	9.37

(3) Comparison of the Geometrical Parameters of the Various Ducts

Table 9 compares the geometrical parameters of the No 19a Holland duct, the N_L duct using Soviet investigator A.M. Basin's calculation method, the N series of ducts of Soviet investigator V.M. Ivanov,⁵ and the SD11 and JD11 dual ducts used in the authors' tests. Figure 5 shows several duct cross sections (because the sectional shapes of the two Soviet ducts are quite similar, only the N_L is shown in the figure).

Table 9. Comparative Geometrical Parameters of Various Ducts

1 Geometrical parameter	2 Duct	3 Main duct	4 Main duct	5 Holland No 19a	6 Soviet N_L	7 Soviet N
8 Length-to-diameter ratio L/D	0.64		0.64	0.69	0.69	0.68
9 Leading edge contraction coefficient	1.200		1.204	1.40	1.30	1.30
10 Trailing edge diffusion coefficient	1.200	1.048	1.190	1.09	1.15	1.12
11 Tail diffusion angle	15°46'	1°35'	10°38'	6°34'	6°17'	5°43'
12 Attack angle	8°	9°18'	8°	9°35'	9°14'	8°50'
13 Thickness ratio t/L	0.12	0.16	0.12	0.16	0.114	0.13
14 Arch ratio f/L	0.05	0.05	0.05	0.05	0.04	0.05
15 Propeller disk surface distance to leading edge L_0/L	0.40		0.40	0.50	0.40	0.35

Key

1. Geometrical parameter
2. Duct
3. Main duct
4. Main duct
5. Holland No 19a
6. Soviet N_L
7. Soviet N
8. Length-to-diameter ratio L/D
9. Leading edge contraction coefficient
10. Trailing edge diffusion coefficient
11. Tail diffusion angle
12. Attack angle
13. Thickness ratio t/L
14. Arch ratio f/L
15. Propeller disk surface distance to leading edge L_0/L

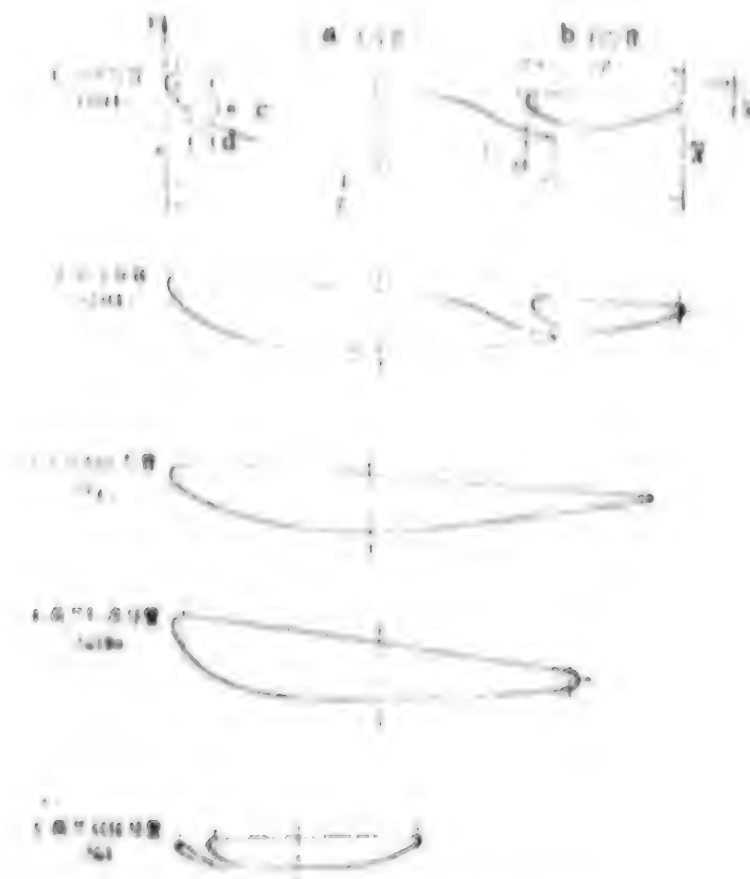


Figure 5. Cross sections of double and other ducts

- | | | |
|------|-------------------|---------------------------------|
| Key: | a. Main duct | 1. JD11 double duct |
| | b. Secondary duct | 2. SD11 double duct |
| | c. Y_{ext} | 3. N_L duct (Soviet) |
| | d. Y_{int} | 4. Holland standard duct No 19a |
| | | 5. Holland double duct No 1 |

B. Propeller Parameters

The Ka propeller model used in the series of tests had a diameter $D = 0.25$ meter. The form parameters for the propeller are given in Tables 10 and 11.⁶

Table 10. Dimensions of Extended Contour of Ka Series Propellers

P/R		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
叶剖面线 图 0.6 尺柱 船大叶剖面 线设计	叶背线 中隔线 1	30.81	35.17	41.45	45.99	49.87	52.93	55.04	56.33	56.44	叶剖面线 7 (0.6 尺) $= 1.589 \frac{1}{2}$ $\approx \frac{A_1}{A_2} D$
	叶背线 中隔线 2	35.94	40.42	43.74	47.02	50.13	52.93	55.04	56.33	56.44	
	总长 3	61.15	76.59	85.19	93.01	100.00	105.86	110.08	112.66	112.88	
叶剖面最大厚度线 设计	5	4.00	3.53	3.00	2.45	1.90	1.38	0.92	0.61	0.50	轴中心线处 的最大厚 度为 $0.047 D$
距叶剖面最大厚度 线到叶背线距离 的设计	6	34.98	39.76	46.02	49.33	49.98	—	—	—	—	

Key:

1. Reference line to trailing edge
2. Reference line to leading edge
3. Total length
4. Blade section chord length as percentage of maximum blade section chord at 0.6R
5. Blade section maximum thickness as percentage of diameter
6. Distance from line of maximum thickness to leading edge
7. Blade section chord...
8. Maximum thickness at axle center line

Key[to Table 11 following page]

1. Longitudinal blade contour of Ka series propeller
2. Maximum thickness to trailing edge
3. Maximum thickness to leading edge
4. Longitudinal contour of blade back
5. Longitudinal contour of blade face

Table 11. Longitudinal Blade Contour of Ka Series Propeller

1											
2						3					
0.2	0.4	0.6	0.8	1.0	1.2	0.2	0.4	0.6	0.8	1.0	1.2
4											
0.2	1.11	1.09	1.10	1.08	1.07	1.03	1.02	1.01	1.00	0.99	0.98
0.3	1.05	1.04	1.04	1.03	1.02	0.98	0.97	0.96	0.95	0.94	0.93
0.4	1.00	0.99	0.99	0.98	0.97	0.93	0.92	0.91	0.90	0.89	0.88
0.5	0.95	0.94	0.94	0.93	0.92	0.88	0.87	0.86	0.85	0.84	0.83
0.6	0.90	0.89	0.89	0.88	0.87	0.83	0.82	0.81	0.80	0.79	0.78
0.7	0.85	0.84	0.84	0.83	0.82	0.78	0.77	0.76	0.75	0.74	0.73
0.8	0.80	0.79	0.79	0.78	0.77	0.73	0.72	0.71	0.70	0.69	0.68
0.9	0.75	0.74	0.74	0.73	0.72	0.68	0.67	0.66	0.65	0.64	0.63
1.0	0.70	0.69	0.69	0.68	0.67	0.63	0.62	0.61	0.60	0.59	0.58
5											
0.2	1.11	1.09	1.10	1.08	1.07	1.03	1.02	1.01	1.00	0.99	0.98
0.3	1.05	1.04	1.04	1.03	1.02	0.98	0.97	0.96	0.95	0.94	0.93
0.4	1.00	0.99	0.99	0.98	0.97	0.93	0.92	0.91	0.90	0.89	0.88
0.5	0.95	0.94	0.94	0.93	0.92	0.88	0.87	0.86	0.85	0.84	0.83

Note: Percentage relative to contour at greatest thickness

[key on preceding page]

3. Open-Water Tests

A. In the open water tests we used constant propeller speed and changed the advance speed to obtain different advance coefficients J . The speed of rotation was 400 rpm. If we take $J = 1$ and ignore acceleration of the water flow by the duct, then using the blade sectional arc length $C_{0.7R}$ at $0.7R$ to calculate the Reynolds number we obtain

$$R_{x_{0.7R}} = \frac{C_{0.7R} V u^2}{\nu} = \begin{cases} 3.24 \times 10^5 (A_2/A_0 = 0.70) \\ 3.94 \times 10^5 (A_2/A_0 = 0.85) \\ 4.63 \times 10^5 (A_2/A_0 = 1.00) \end{cases}$$

B. The nominal gap between the propeller tips and the duct was 1.03 mm ($\Delta = 0.42 D$). Because of machining error, the actual gap was larger for some blades (maximum gap 1.5 mm), and the calculations were made on the basis of the average actual diameter.

C. Before the experiment, we determined the instruments' internal friction losses, the boss resistance and the resistance of the duct bracket, and corrections were made for these in the calculations. In determining the duct bracket resistance, we took into account interaction between the duct and the bracket.

D. The instruments used to determine propeller thrust and torque were West German JOB and J11 propeller dynamometers, while the duct thrust was determined by a mechanical duct thrust instrument.

E. Before each experiment, static checking and repeated testing of the instruments was carried out. In general, the results of successive tests with a standard propeller could be plotted on the same curve; for the ducted propellers, provided that it is installed correctly, the repeatability was within the limits of experimental error.

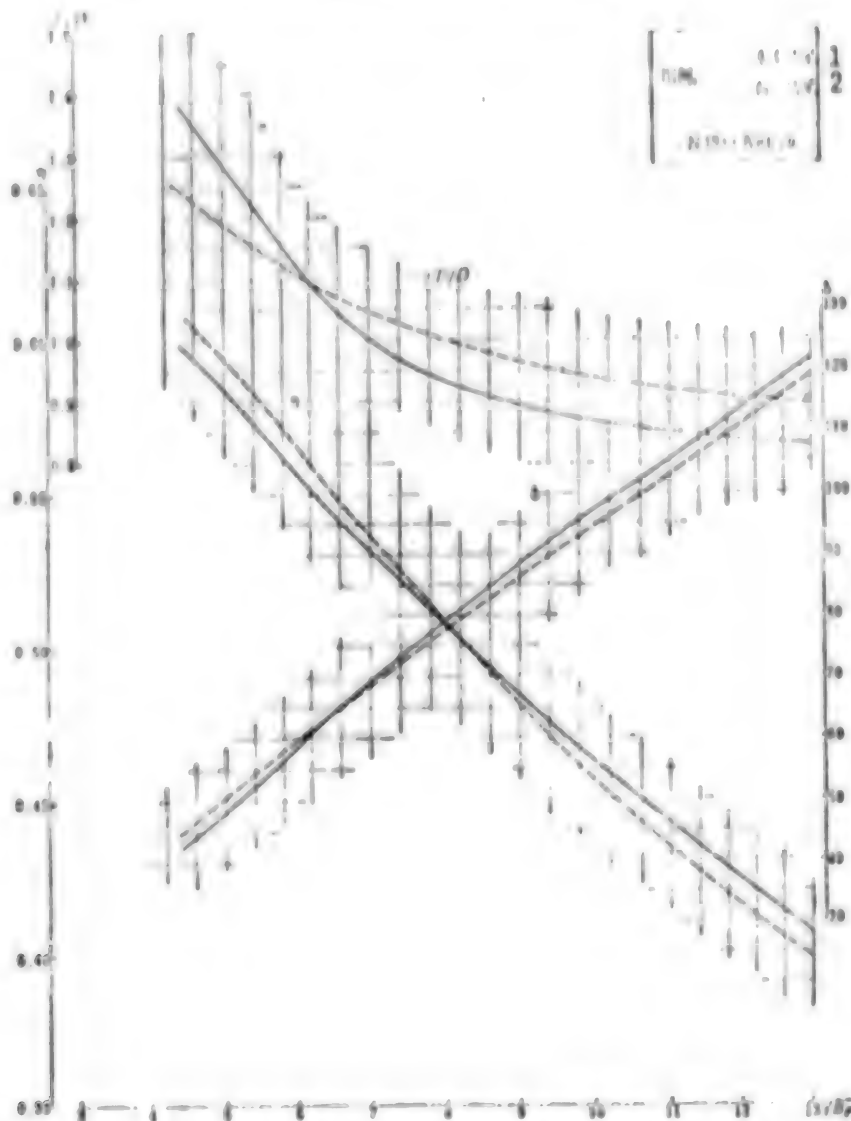


Figure 7. Experimental curves for No 19a + Ka4-70

Key: 1. Results in this article 2. Holland results

In order to make comparisons, during the series tests we also specially repeated the Holland towing tank standard ducted propeller series No 19a + Ka4-70 open-water tests, and the data were quite close to past published data for this propeller. On the plot which the authors made of their own experimental results, the best efficiency curve showed a discrepancy from the published Holland results of less than 0.01, and they were almost identical in the medium loading range, while the optimum diameter lines almost coincided (see Figure 7).

F. During the experiment, flow observations were made of the leading and trailing edges and inner and outer walls of the ducts.

4. Regression Analysis of the Experimental Data

An electronic computer was used to carry out regression analysis of advance speed, rotation speed, duct thrust, propeller thrust and torque

For the duct thrust coefficient K_{TD} , the propeller thrust coefficient K_{TP} and the torque coefficient $10K_Q$, the proper bivariate polynomials empirical regression surface were used to express the relationship to pitch ratio P/D and advance coefficient J :

$$K_{TD} = \sum_{x=0}^{n_1} \sum_{y=0}^{n_2} A'_{xy}(P/D)^x J^y$$

$$K_{TP} = \sum_{x=0}^{n_1} \sum_{y=0}^{n_2} C'_{xy}(P/D)^x J^y$$

$$10K_Q = \sum_{x=0}^{n_1} \sum_{y=0}^{n_2} B'_{xy}(P/D)^x J^y$$

The empirical regression surface for the total thrust coefficient K_{TC} can be expressed by the following formula

$$\begin{aligned} K_{TC} = K_{TD} + K_{TP} &= \sum_{x=0}^{n_1} \sum_{y=0}^{n_2} A'_{xy}(P/D)^x J^y + \sum_{x=0}^{n_1} \sum_{y=0}^{n_2} C'_{xy}(P/D)^x J^y \\ &= \sum_{x=0}^{n_1} \sum_{y=0}^{n_2} A_{xy}(P/D)^x J^y \end{aligned}$$

Table 12. Regression Coefficients for SD11 Double Duct + Ka Series

n	k	SD11 + Ka1 = 10			SD11 + Ka1 = 85			SD11 + Ka1 = 100		
		$A_{12}(K_{12})$	$B_{12}(10K_{12})$	$C_{12}(K_{12})$	$A_{12}(K_{12})$	$B_{12}(10K_{12})$	$C_{12}(K_{12})$	$A_{12}(K_{12})$	$B_{12}(10K_{12})$	$C_{12}(K_{12})$
0	0	0.101659	0.111110	0.011000	0.119129	0.000000	0.213811	0.221013	0.100026	0.101644
0	1	0.101619		0.200094	0.713540		0.107517	0.100000		0.101609
0	1	0.101622		0.227021	-1.056154	0.230072	0.708816	-1.029124	0.049611	0.101677
0	1				0.400503	2.795726	1.171434	0.797643	1.261749	0.101641
0	1	0.091301		-0.091301	-1.370633	3.086945	1.320533	-1.178531		-1.000057
0	0	0.227570	0.137248							
0	1				0.110944		0.110944	0.110944	-0.200079	0.201600
1	0	0.101615	0.044624	0.253947	1.032110	-0.191051	0.046078	0.748141	-1.194109	-0.101672
1	1		-0.207337		-1.571137		-2.113700	-1.737109	-0.110094	0.091533
1	2				1.933198	-1.247182	1.249669	1.006278		1.016970
1	3									
1	4				0.854307				1.041000	
1	5					3.266210				
1	0	0.101612			0.101607					
2	0	0.030513			-0.857100	0.103543	0.252106	1.550794	1.374301	0.099531
2	1	-0.120099		-0.200213	1.111497		0.090070	0.573354		
2	2	0.217031	-0.170033						-0.701474	
2	3	-0.191164			0.720907					
2	4									
2	5									
2	0		0.047183							
3	0	0.001028	0.005028	0.094078			0.094078	-0.491312		-0.111064
3	1		0.108930		-0.539312	0.100914	-0.539312	-0.100000	0.264034	-0.100000
3	2	0.071081	0.010081			0.502941		-0.374123		-0.100000
3	3									
3	4									
3	5									
3	0	0.061496				-1.080104				
4	0		0.097467					0.026053	-0.127054	
4	1									0.091140
4	2									
4	3									
4	4				0.263722		0.188192	0.382363	-0.614965	0.157465
4	5				-0.075158		-0.075158	-0.125594		-0.001091
5	0									
5	1									
5	2								0.216393	
5	3									
5	4									
5	5									
6	0									
6	1								-0.001454	
6	2									
6	3									
6	4									
6	5								0.190013	
6	0				0.165841				-0.001520	

Using a bivariate regression analysis program, we made calculation on the experimental data for the Ka4-70, Ka4-85 and Ka4-100 propeller series with the SD11 and JD11 ducts, and on the No 19a + Ka-70 combination. In this article we give the regression coefficients open water characteristic curves and design curves only for the SD11 + Ka series, which had the best characteristics (see Figures 36-41).

5. Comparative Analysis of the Experimental Results.

We selected the following coefficients as characteristics to be used in comparison analysis of ducted propeller capabilities:

- (1) Total thrust coefficient

$$C_T = \frac{T}{\frac{1}{2} \rho V_A^2 \cdot \frac{\pi D^4}{4}} = \frac{8}{\pi} \frac{K_T}{J^4}$$

- (2) Thrust ratio (ratio of propeller thrust to total thrust)

$$\tau = \frac{T_p}{T_o + T_p} = \frac{T_p}{T_t}$$

- (3) Actual efficiency

$$\eta_a = \frac{J}{2\pi} \frac{K_T}{K_Q}$$

- (4) True efficiency (ratio of actual efficiency to ideal efficiency, also called quality factor)

$$\eta_t = \frac{\eta_a}{\eta_i}$$

where η_i is the ideal efficiency:

$$\eta_i = \frac{2}{1 + \sqrt{1 + C_T}}$$

- (5) Design coefficients (power loading coefficient)

$$B_r = \frac{NP_D^{1/4}}{V_A^{1/4}} = 33.35 \sqrt{\frac{K_Q}{J^4}}$$

$$B_o = \frac{NP_T^{1/4}}{V_A^{1/4}} = 13.30 \sqrt{\frac{K_T}{J^4}}$$

where P_D is the delivered horsepower, P_T is the thrust horsepower (metric, fresh water $\rho = 102 \text{ kg-sec}^2/\text{m}^4$).

- (6) Speed ratio

$$\delta = \frac{ND}{V_A} = \frac{30.89}{J}$$

$$\delta^* = \frac{ND_{\max}}{V_A} = \frac{D_{\max}}{D} \cdot \delta$$

where D_{\max} is the maximum outside diameter of the duct and D is the diameter of the propeller.

(7) Efficient coefficient

$$\eta_D = \frac{(K_s/\pi)^{1/4}}{K_D}$$

A. The Effect of Dual Duct Geometric Parameters on Thrust Characteristics and a Preliminary Comparison of the Dual Duct with the Other Two Single Ducts

In the initial stage of research, in order to select the prototype dual duct, open-water tests were conducted on 9 JD series dual ducts paired with the K'4-88 propeller (P/D = 1.03).

Figures 8-10 show the experimental results for the K'4-88 (P/D = 1.03) paired with various ducts.

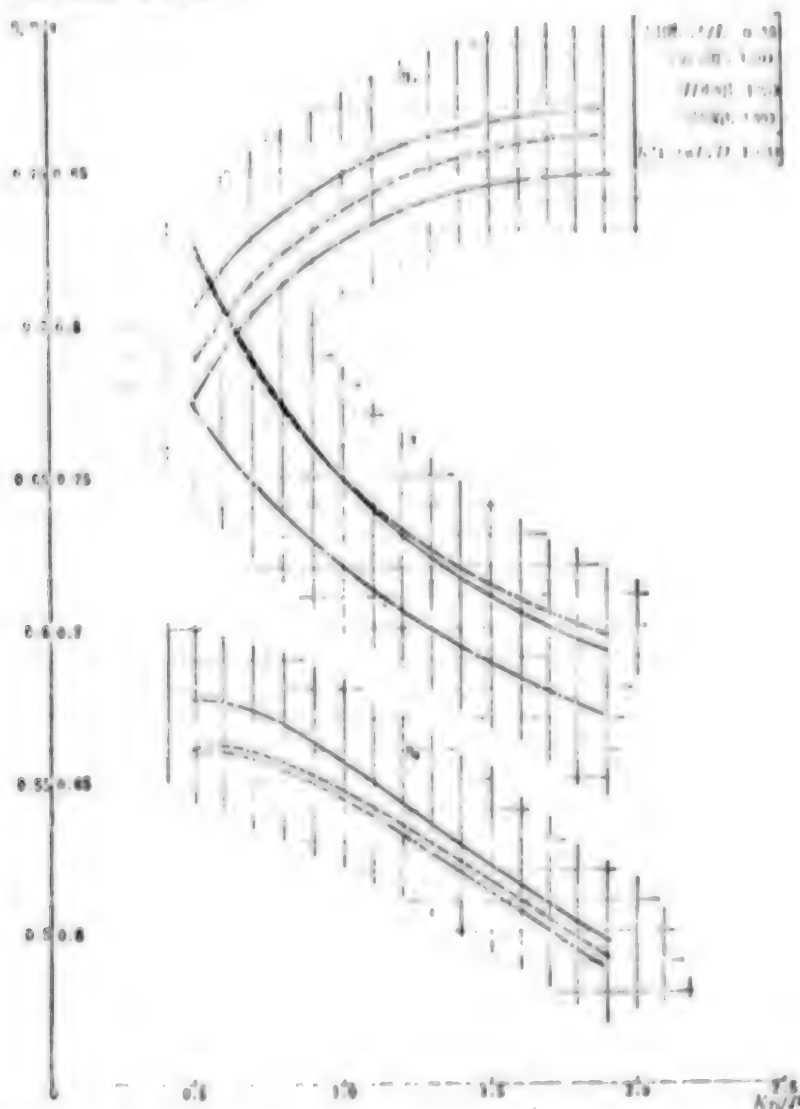


Figure 8. Effect of diffusion coefficient for slot position $l'/L = 0.30$

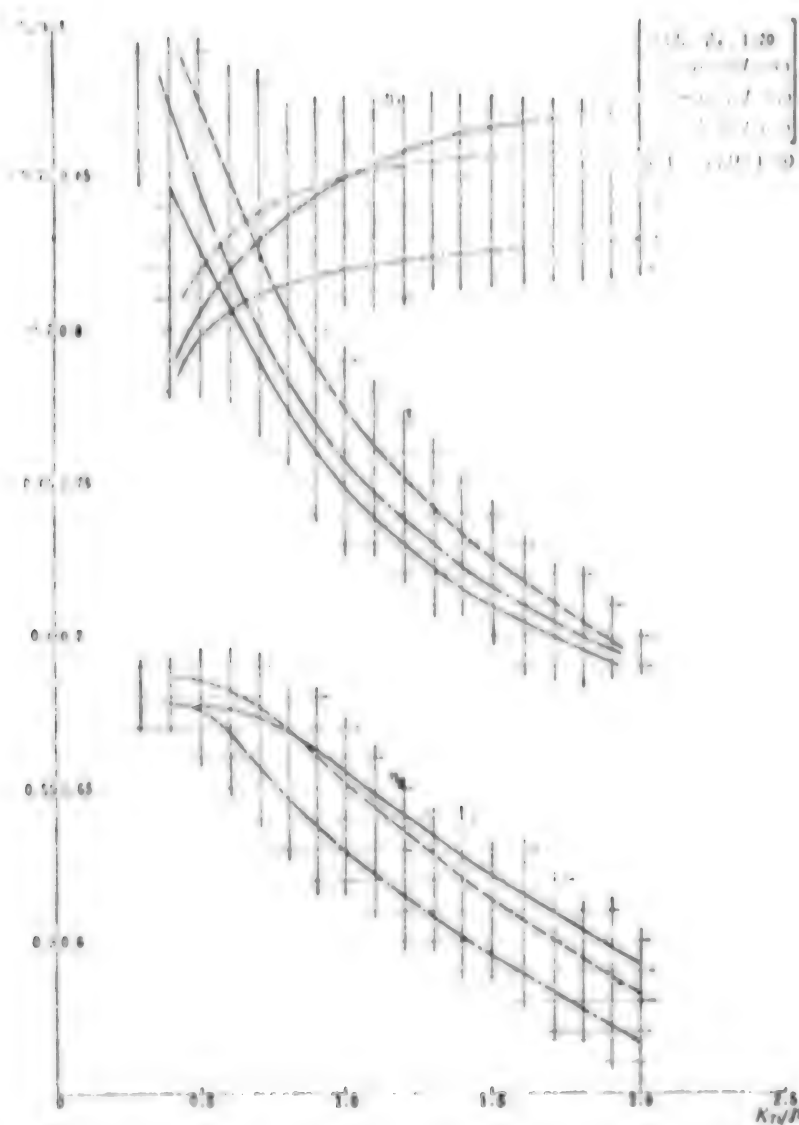


Figure 9. Effect of slot position for diffusion coefficient $\beta_a = 1.20$

Figure 8 gives the curves of η_r , η_0 and $\tau = K_{Tt}/J^2$ for the dual ducts JD11, JD12 and JD13, which have the same slot position ($l'/L = 0.30$) but different diffusion coefficients. As can be seen from the figure, for the JD13, which has the largest diffusion coefficient, the greatest acceleration of the waterflow, the smallest τ and the maximum ideal efficiency, the actual efficiency is the lowest, and it is clear that the diffusion is excessive, making the slot unable to resist separation of the waterflow: $\beta_a = 1.30$ is excessive. In order to compare the effect of slot position on the characteristics, we plotted curves of η_r , η_0 and $\tau = K_{Tt}/J^2$ for the JD11, JD12 and JD13, which have the diffusion coefficient $\beta_a = 1.20$ (see Figure 9). It can be seen from the figure that the slot position

should not be too close to the propeller, and the main duct should not be too short, because the high energy waterflow enters too early from the slot and has no effect in delaying separation, and thus does not improve efficiency. It can be seen from these figures that in the vicinity of the design loading ($K_{Tt}/J^2 \approx 0.9$, thus C_{T42}), the JD11 and JD21 have the highest efficiencies of the 9 ducts.

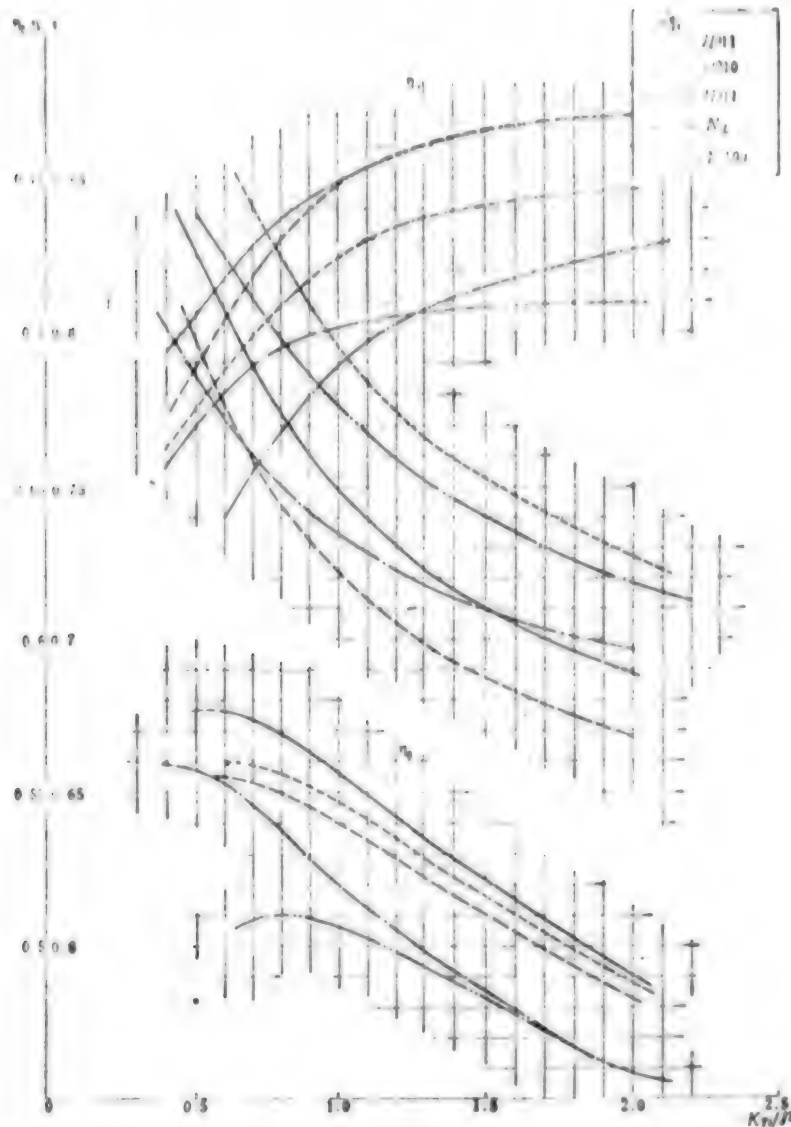


Figure 10. Characteristics of K'4-88 paired with various ducts

Figure 10 shows comparison curves for the JD11 duct, the JD11 with the slot blocked ($L/D = 0.64$), the JD10 main duct above (without the secondary duct, $L/D = 0.48$) and the Holland duct No 19a and Soviet N_L duct. First, with regard to the JD10, JD11 and JD11, in which the forward part of the

section is identical and the rear part different, τ is the smallest for the JD11, has an intermediate value for the JD11 and is greatest for the JD10; the ideal efficiency order is the reverse. But in actual efficiency, the slotless JD11 is the lowest, and the slotted JD11 is the highest. This shows that with the large diffusion coefficient of the JD11 and JD11 ($\beta_d = 1.20$), tail diffusion angle $\gamma = 15^\circ 44'$, the JD11 with no slot showed separation from the trailing surface, lowering efficiency. Because the slot of the JD11 effectively prevented separation, this duct's efficiency was the highest. As regards the single-duct JD10 and the JD11 to which a secondary duct had been added, the increase in actual efficiency resulted from adding the secondary duct, accelerating the flow in the vicinity of the propeller disk, which decreased the value of τ and increased the ideal efficiency; in this case the real efficiency did not decrease. If we block the slot, the acceleration is more abrupt, τ is even smaller and the ideal efficiency is even higher, but the actual efficiency is even lower than that of the JD10 with a much smaller diffusion coefficient ($\beta_d = 1.048$), indicating that this is also produced by waterflow separation.

Comparing the open-water test characteristic curves of the above ducts, it is clear that when the forward part of the duct cross section is the same, regardless of differences in the rear section, for identical J values, the values of K_{TD} are almost identical (see Table 13), and it is only the values of K_{TP} and K_Q which differ under these circumstances.

Table 13. Values of $K_{TD}(J)$ for JD Ducts with Same Forward Part and Different Rear Parts

Duct	J K_{TD}									
		0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
JD11		0.275	0.234	0.176	0.131	0.091	0.058	0.028	-0.001	-0.027
JD11		0.271	0.231	0.174	0.130	0.091	0.058	0.028	-0.003	-0.034
JD10		0.271	0.221	0.174	0.130	0.091	0.058	0.028	-0.002	-0.034

Similarly, if we used the K'4-88 propeller and the 9 ducts of the JD series which differ in the position of the slot and in diffusion angle, the experimental K_{TP} and J curves are largely the same, and the 9 curves all fall within a very narrow band (see Table 14).

Table 14. Values of $K_{TP}(J)$ for Nine JD Series Ducts with Different Slot Position and Diffusion Coefficient

Duct	β	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
J100	0.113	0.276	0.176	0.131	0.093	0.058	0.038	0.001	0.037	
J102	0.170	0.300	0.174	0.127	0.088	0.056	0.025	0.002	0.030	
J104	0.240	0.328	0.180	0.120	0.081	0.047	0.028	0.003	0.034	
J106	0.345	0.381	0.174	0.129	0.089	0.054	0.024	0.001	0.034	
J108	0.500	0.476	0.178	0.133	0.096	0.060	0.026	0.004	0.030	
J110	0.771	0.510	0.170	0.127	0.087	0.063	0.021	0.007	0.036	
J112	0.973	0.518	0.171	0.128	0.089	0.066	0.028	0.008	0.038	
J114	0.776	0.518	0.171	0.128	0.089	0.066	0.028	0.004	0.037	
J116	0.178	0.339	0.181	0.126	0.087	0.063	0.027	0.009	0.038	

The above results indicate that the force acting on the duct is primarily determined by the value of J , the propeller geometry and the shape of the forward cross section of the duct, and in general terms it is unrelated to the shape of the rear section of the duct. However, the rear part of the duct cross section does have a relatively large effect on the values of K_{TP} and K_D for the propeller. Accordingly, the effect of the shape of the duct rear cross section on the distribution of thrust between the duct and the propeller is rather closely connected with the efficiency of the propulsion unit. Moreover, in view of the calculated figures for ducted propellers and actual measurements of the pressure distribution on the duct surface⁷ (Figure 11), in the vicinity of the design loading, the section of the duct where the thrust is largest results from a negative pressure peak acting on the inner surface between the leading edge and the



propeller disk surface. Because the thrust produced by the pressure distribution in the rear part of the duct is only a small percentage of the whole, the effect of waterflow separation at the inner surface of the trailing edge on the duct thrust coefficient is relatively small. Another reason that efficiency drops, other than increased viscous losses, may be that after the near-surface layer separates, the duct trailing edge effective outlet cross section is smaller than the geometric outlet cross section, so that there are kinetic energy losses in the tail race.

Figure 11. Real values of pressure distribution over duct surface

Figure 12 shows comparative characteristic curves for the abovementioned three ducts paired with the 3-bladed KCS11.54 propeller, which differs in number of blades and contour from the K'4-88; it shows that in the vicinity of the design loading, the dual duct has the highest efficiency.

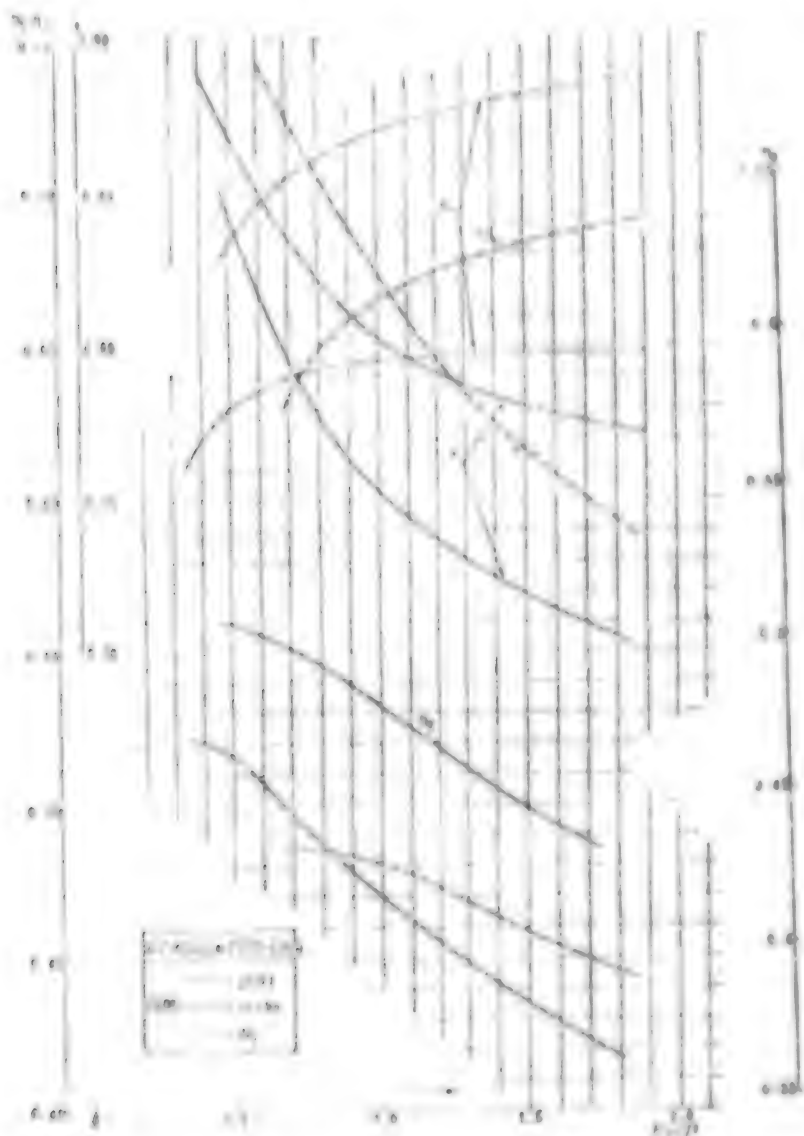


Figure 12. Performance characteristics for KCA511.54 propeller with various ducts

Summarizing the above, it is clear that regardless of whether the JB11, No 19a of S_1 ducts are paired with 4-bladed square-head propellers or 3-bladed round-tip propellers, for the same propeller, the dual duct always shows the highest efficiency.

On the basis of this preliminary qualitative analysis, the authors decided to use the JB11 as the prototype dual component duct, and for convenience

of machining and in order to decrease the possibility of near-surface layer separation near the tail of the duct during heavy loading, they also designed the SD11 dual duct propeller, in which the primary changes were smaller diffusion angles for the main and secondary ducts, and a larger radius of curvature of the trailing edge. In order to investigate the effect of these changes on dual duct propeller characteristics, we then used both the JD11 and SD11 ducts with the Ka4-70, Ka4-75 and Ka4-100 series propellers, a total of 15 propellers, for open-water tests.

B. Comparison of the Characteristics of the Dual Duct Propeller Series with the Other Three Ducted Propeller Series

Figure 13

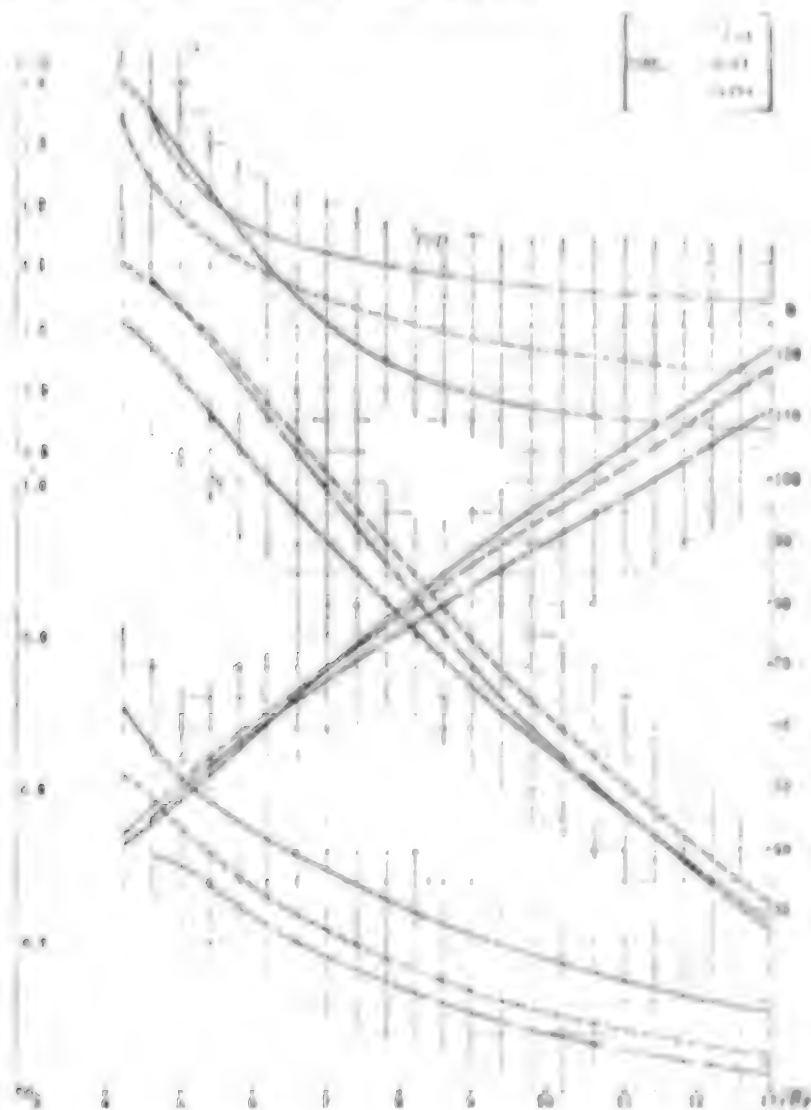


Figure 13. Comparison curves for duct characteristics ($\sqrt{B_p}$)

Figure 13 shows comparative characteristic curves for the authors' experiments on the JD11, SD11 and No 19a ducts. It can be seen from the figure that at low or medium loading, the double duct propellers have the highest efficiency, while at heavy loadings the optimal diameter decreases. It can be seen from comparison of the SD11 and JD11 that with heavy loading, because the suitable decrease in the large diffusion ratio at the tail produces an efficiency increase which is larger than the efficiency loss resulting from increasing the radius of curvature of the trailing edge of the main and secondary ducts, the heavy-loading efficiency of the SD11 is slightly higher than that of the JD11, while at medium and light loading they are close together. The diffusion angle at the tail of the JD11 is slightly larger, and the optimum radius is smaller, than for the SD11. For comparison of their characteristics, see Figure 14.

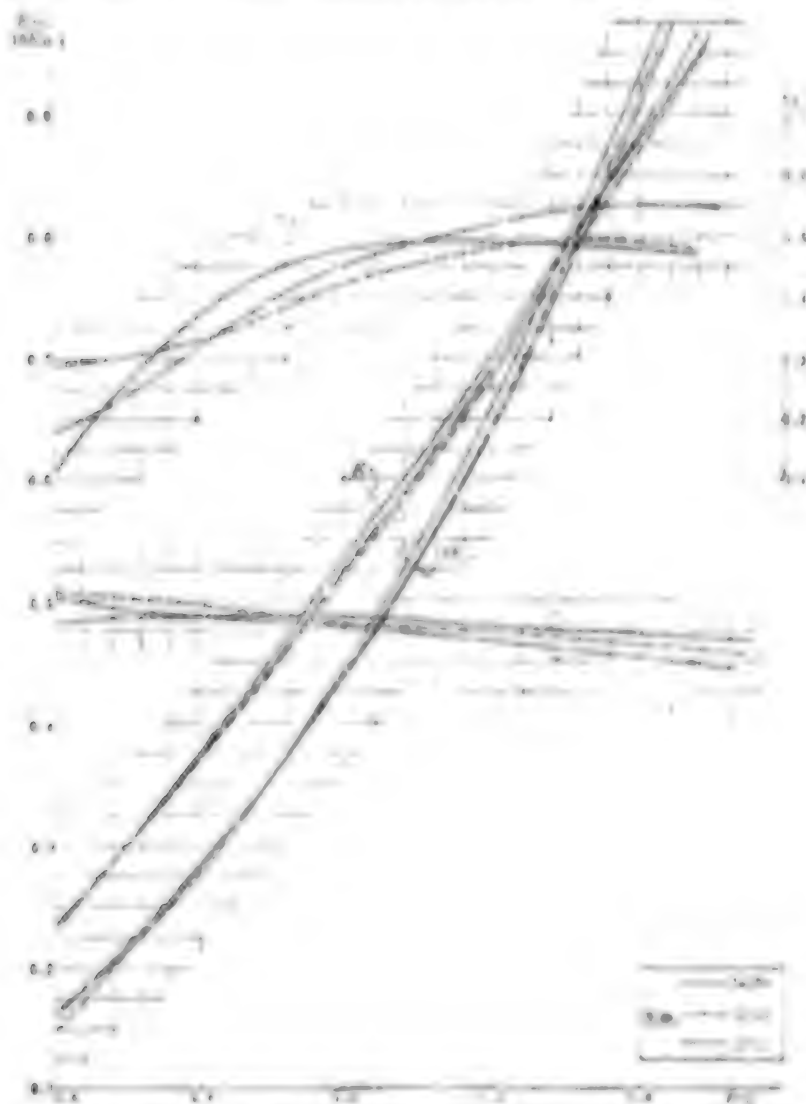


Figure 14. Ducted propeller mixed characteristics

Moreover, for a large disk area ratio $A_E/A_0 = 1.0$, Figure 15 gives the comparative characteristics of the SD11 + Ka4-100 series, and the Soviet V.M. Ivanov 4-bladed ducted propeller series. Because the model experiment conditions were different (in the latter case the tip gap was larger and the Reynolds number higher), we can only make a very general comparison. On the basis of this rough comparison, the dual ducted propeller series gives the higher efficiency.

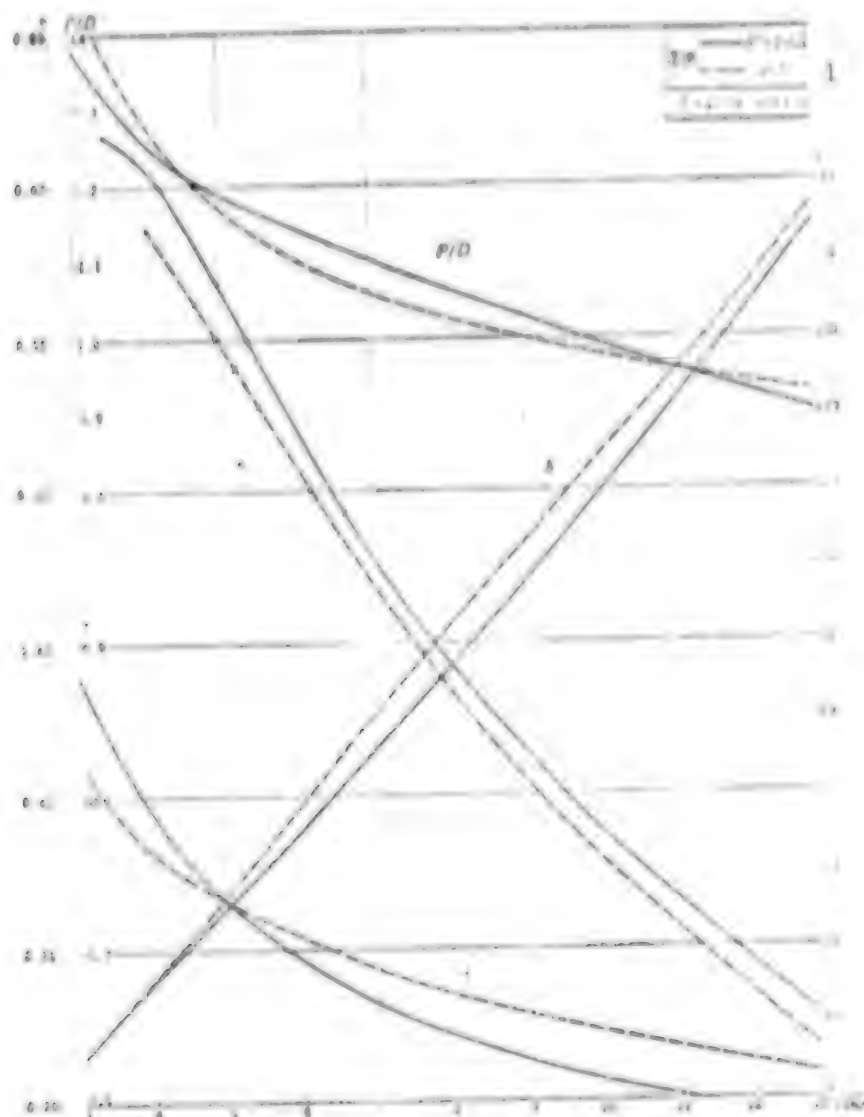


Figure 15. Performance comparison with large disk area ratio Soviet ducted propeller

Key: 1. Soviet

Figure 16 gives comparative characteristic curves for the Ka4-70 propeller with the JD11 and SD11 ducts and the Holland towing tank loading edge slotted-airfoil dual duct No 1.⁸ It can be seen that for light loading the three have about the same efficiency, and the leading edge and trailing edge slots prove to be different approaches with equally satisfactory performance. However, for medium and heavy loading the trailing edge slotted-airfoil dual duct propeller maintained its higher efficiency.

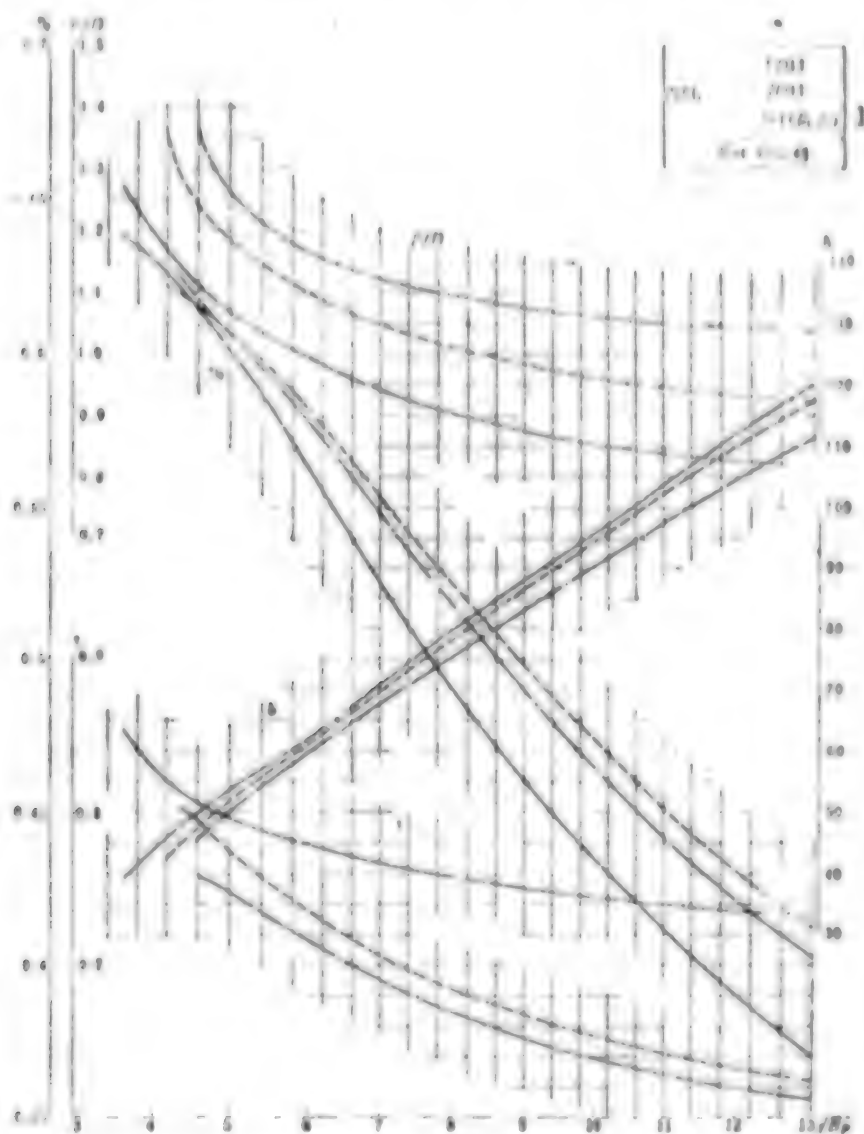


Figure 16. Comparative characteristics of three dual ducted propellers

Key: 1. Holland

C. The Effect of the Pitch Ratio

Figures 17-19 give comparative characteristic curves for the JD11, SD11 and No 19a ducts paired with propellers with pitch ratios P/D of 0.6, 1.0 and 1.4 (disk area ratio $A_E/A_0 = 0.7$).

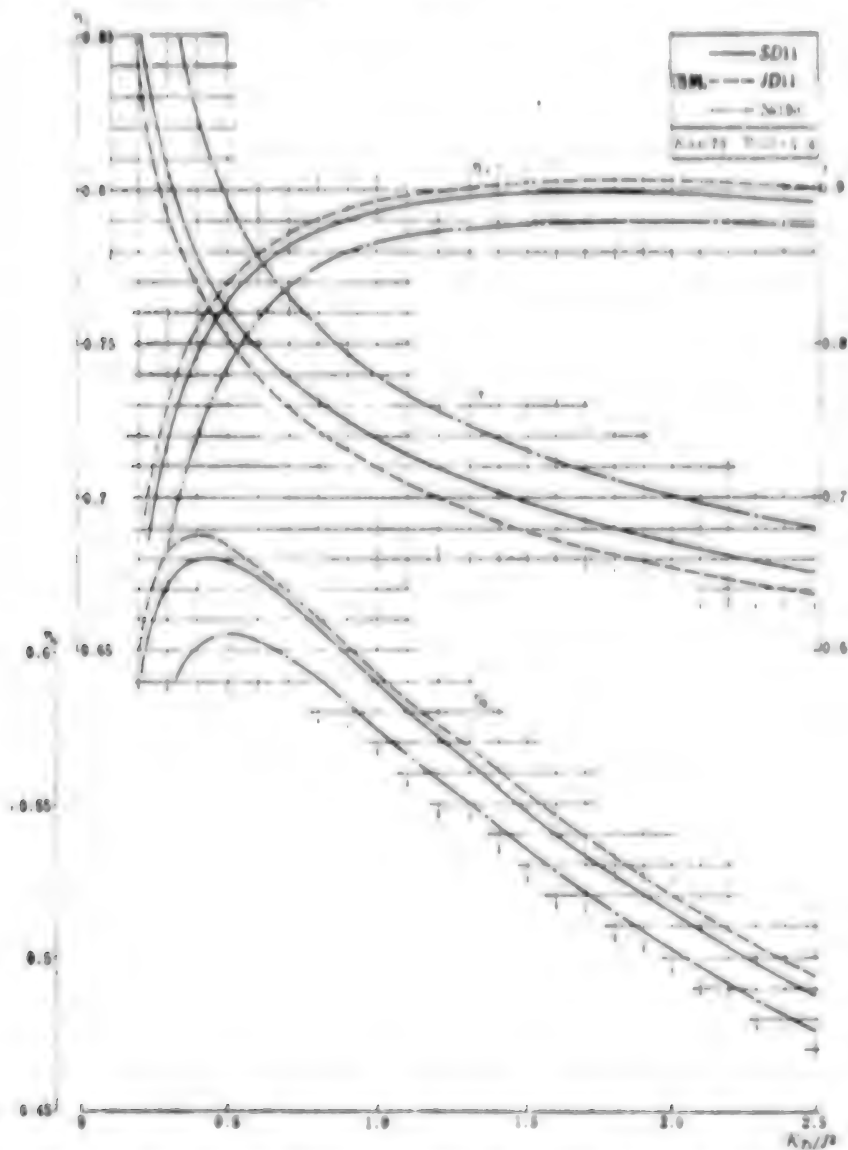


Figure 17. Effect of pitch ratio (P/D) of three ducted propellers ($P/D = 1.0$)

From these figures it can be seen that when the pitch ratio is large, which corresponds to light loading, the three ducts with different tail diffusion angles have curves for τ , η_0 and $\eta_r K_{Te}/J^2$ which do not intersect but form a regular series. The JD11, whose tail diffusion angle is the largest, has the smallest value of τ , the greatest waterflow

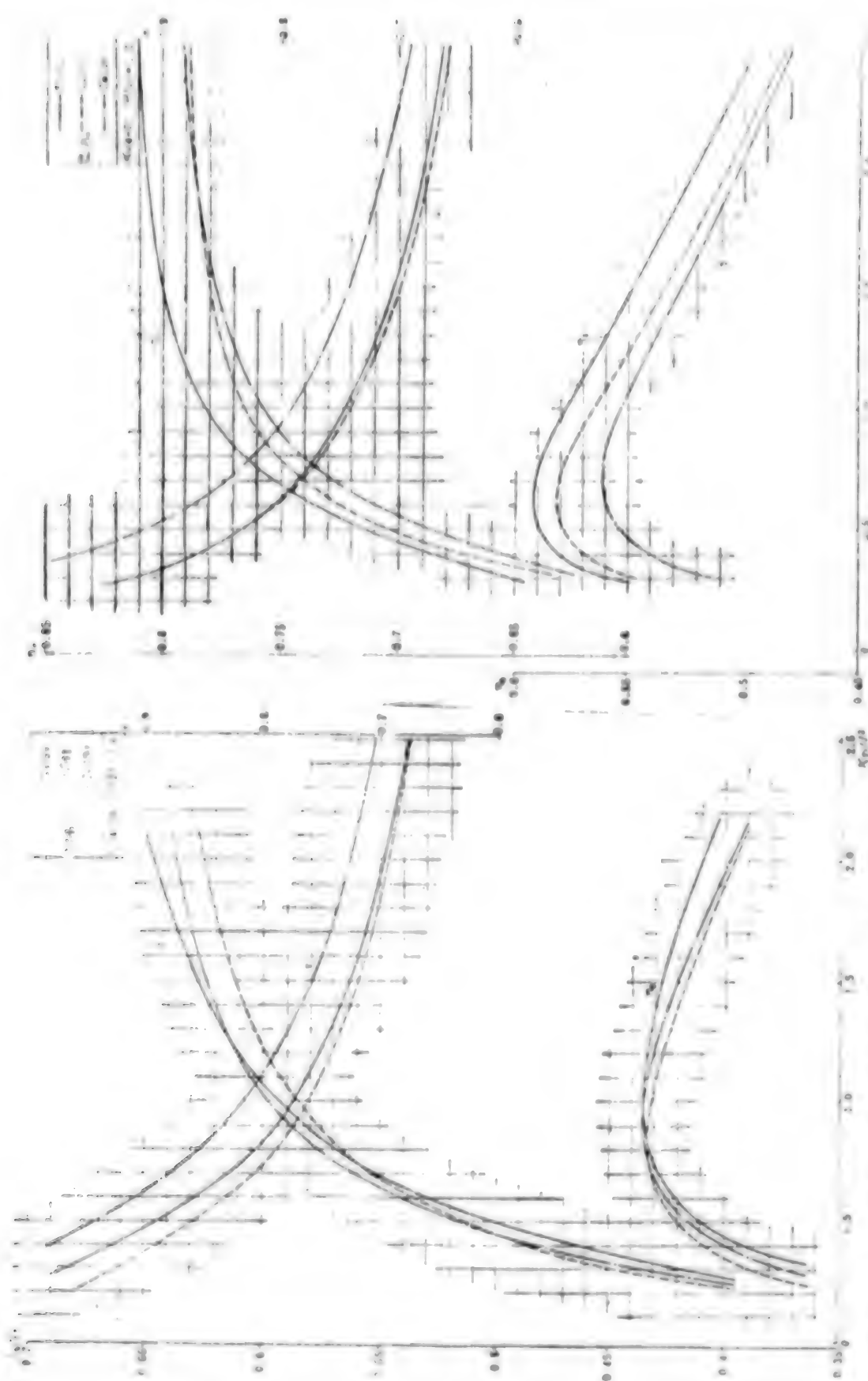


Figure 18. Effect of pitch ratio of three ducted propellers ($P/D = 1.0$)

Figure 19. Effect of pitch ratio of three ducted propellers ($P/D = 0.5$)

acceleration, and the highest values of η_0 and η_T ; the SD11, with an intermediate tail diffusion angle, has an intermediate value of τ and its η_0 and η_T values are slightly lower than for the JD11; and the No 19a, with the smallest tail diffusion angle and the largest τ , has the lowest values of η_0 and η_T . When the pitch ratio is small, which is equivalent to heavy loading, the JD11, with the greatest tail diffusion angle, still has the smallest value of τ , but η_0 and η_T have become the lowest. From these two extreme circumstances it is easy to conclude that under heavy loading the propeller tail race is rather considerably contracted and the waterflow separates from the inner surface of the JD11 duct trailing edge, while under light and medium loading there is no separation.

D. The Effect of the Disk Area Ratio

Figures 20 and 21 give comparative characteristic curves for the SD11 and JD11 ducts respectively with propellers of three different disk area ratios. It can be seen from the figures that for the SD11, the effect of the disk area ratio is rather regular. As the disk ratio increases, the optimum efficiency η_{opt} and the optimum speed ratio δ_{opt} both decrease, and the optimum pitch ratio P/D_{opt} increases. The decrease in the optimum efficiency becomes greater as the propulsion unit loading increases. For the JD11, under medium loading, in general terms the pattern is the same as for the SD11, but when $Bp \geq 80$, it differs from the above pattern, and as the disk area ratio increases, even though the optimum efficiency decreases, the optimum speed ratio δ_{opt} increases, and the optimum pitch ratio P/D_{opt} decreases. As for the efficiency drop produced by the disk area ratio, when the disk area ratio A_E/A_0 increases from 0.70 to 0.85, the optimum efficiency is almost unchanged, but when the disk area ratio further increases to 1.0, the optimum efficiency finally drops noticeably.

The tail diffusion angles of the SD11 and JD11 differ by more than 5° , resulting in different waterflow separation characteristics, which may be one cause of the differences in the effect of the disk area ratio. In addition, because the experiments inevitably have a certain amount of error, and because they were calculated with a bivariate regression analysis program, and no three-variable regression analysis which included the effect of the disk area ratio A_E/A_0 was conducted on experimental results of three different disk area ratios in a single duct, it may be that different errors account for the fact that the disk area ratio has different effects.

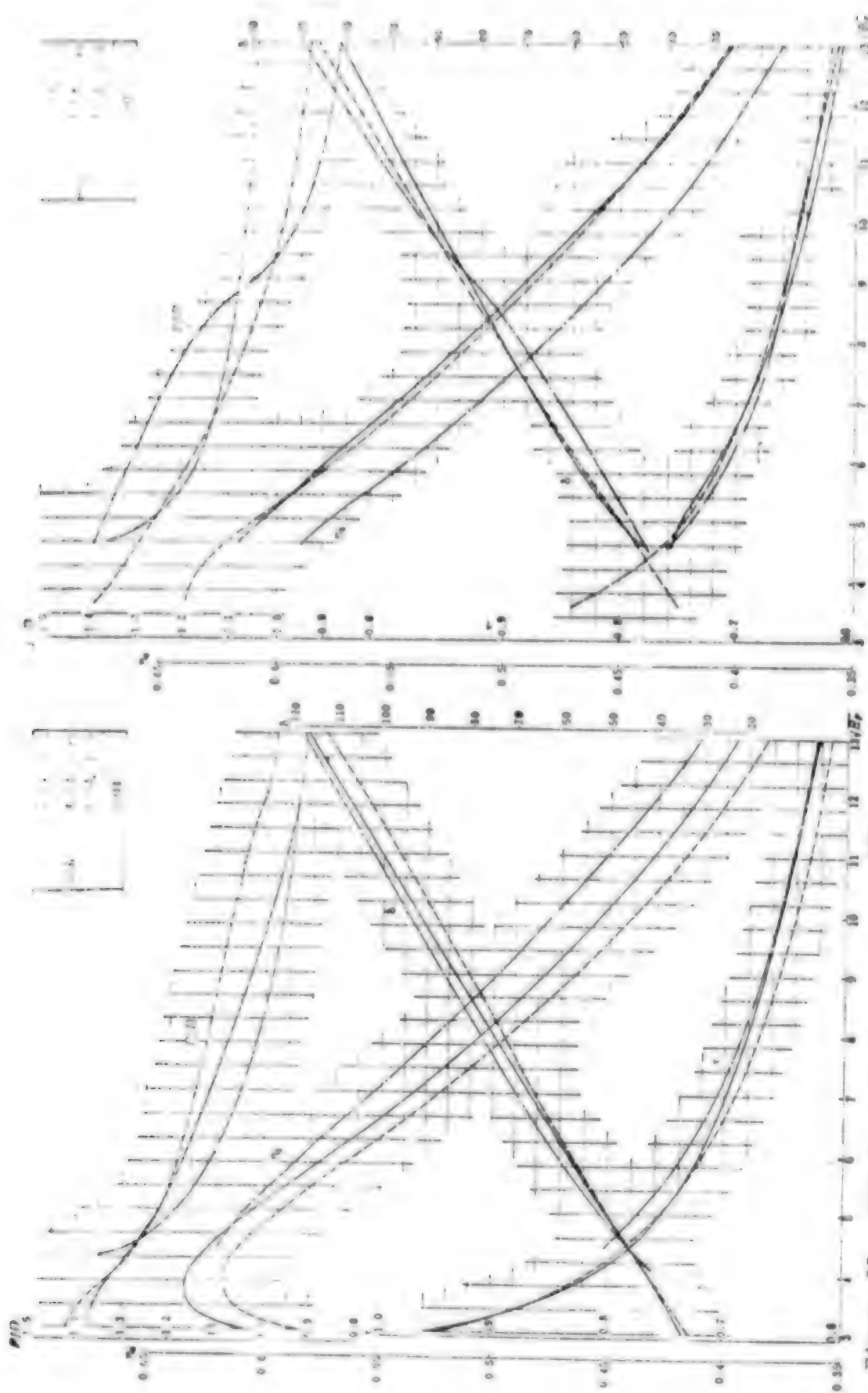


Figure 20. Effect of disk area ratio ($\sqrt{B_p}$) of SD11 double duct + Ka series

Figure 21. Effect of disk area ratio ($\sqrt{B_p}$) of JD11 duct + Ka series

E. Preliminary Observations of Separation

In conducting open-water tests on the SD11 (I) + Ka4-85 (P/D = 1.4, 1.2, 1.0) and ID21 + Ka4-70 (P/D = 1.4, 1.2, 1.0) dual component duct combinations, we made use of threads attached to the external surfaces of the leading edges of the main and secondary ducts and the inner surface of the leading edge of the main duct and the trailing edge of the secondary duct to make preliminary observations and photographs of separation. Figures 23-35 [not reproduced] show typical flow states in the areas mentioned. We now give a preliminary summary and analysis of the observations:

(1) Under moored conditions ($C_T = \infty$, $\tau \approx 0.5$), with a duct calculated for ordinary conditions (free sailing or towed), on the inner surface of the leading edge there was clear water flow separation. At this time the threads there moved irregularly from side to side. This is because the induced velocity field produced by propeller rotation has a rather large positive value relative to the average incident flow attack angle of the duct cross section, and the forward qianzhu [0467 7465] point is on the outer surface of the duct. When the waterflow passes around the leading edge and enters the duct, it produces on the inner surface of the leading edge behind the negative pressure peak a rather large negative pressure gradient, so that the near-surface layer there separates; this is also the reason for "loss of speed" large attack angle bypass flow over a two-component airplane wing section.

If a slot is made in the leading edge of the duct or if the angle α between the duct section transverse line and the propeller axis is increased, it is possible to delay or decrease separation and improve the moored performance characteristics.

(2) Near the design loading, there is no separation from the inner and outer surfaces at the leading edge of the duct. At this time the threads rest stably in the flow, and do not waver. This is equivalent to vibration-free incident flow in bypass flow around an airfoil section at a small attack angle.

(3) With light loading, smaller than the design loading, when the duct thrust coefficient K_{TD} is near zero, and before the efficiency approaches the peak value η_{Dmax} ($C_T \rightarrow 1$, τ (slightly less than 1)), a marked flow separation begins to appear on the exterior leading edge of the duct, after which the strings in that location begin violent circumferential and axial vibration. Comparing this with the open-water characteristic curves, where the advance J for this point is equal to J_{gm} which is equivalent to the point of the curve $K_{TD} \sim J$, i.e. when $J = J_S$, $\frac{\partial^2 K_{TD}}{\partial J^2} = 0$; when $J < J_S$, $J_{TD} \sim J$ is a concave curve. After passing through the separation

point, when $J > J_g$, the $K_{TP} \sim J$ curve becomes convex, and J_{TP} begins to fall rather rapidly.

6. Conclusions

On the basis of analysis of the results of the series of experiments described above and flow separation observations, we can make the following three conclusions:

A. In terms of efficiency, the use of a trailing edge slot, flap-type dual-duct cross-section is an effective measure for preventing waterflow from separating from the inner surface of the trailing edge of the duct. The dual-ducted propeller has an efficiency in open-water tests at light and medium loading which is slightly higher than for ordinary ducted propeller series, while at heavy loading the efficiencies are similar and the optimal diameter is somewhat smaller.

By selecting the geometric parameters of the ducted propeller more rationally (for example, suitably decreasing the duct length-to-diameter ratio D , the thickness ratio t/L and the angle of attack while keeping a large diffusion angle at the tail), and by adding a flow stator at the inner surface of the secondary guide and pairing it with large pitch ratio propellers (e.g. $P/D = 1.4, 1.6$), it is estimated that it would be possible to further increase the dual ducted propeller's light-load efficiency and expand the range of utilization of ducted propellers.

B. The tail diffusion angle of the main duct is about 7° . When only the main duct is used with the propeller, our experiments showed that in view of the simplicity of the structure, ease of manufacture and non-use of slots to prevent separation, the principal duct's geometric parameters (tail diffusion angle $\gamma = 7^\circ$, leading edge contraction coefficient $\alpha_e = 1.35$, trailing edge diffusion angle $\beta_a = 1.05$, length-to-diameter ratio $L/D = 0.5$, thickness ratio $t/L = 0.16$, arch ratio $f/L = 0.05$) could be used to design a straight-line external wall single duct; it is estimated that this would not have waterflow separation from the inner surface of the trailing edge.

C. Waterflow separation from the surface of the duct is an important factor affecting the ducted propeller's performance characteristics. In order to achieve a correct understanding of this physical phenomenon and find measures for preventing separation under various particular situations, and to improve further the characteristics of ducted propellers, it is necessary to conduct more thorough observation and recording of separation.

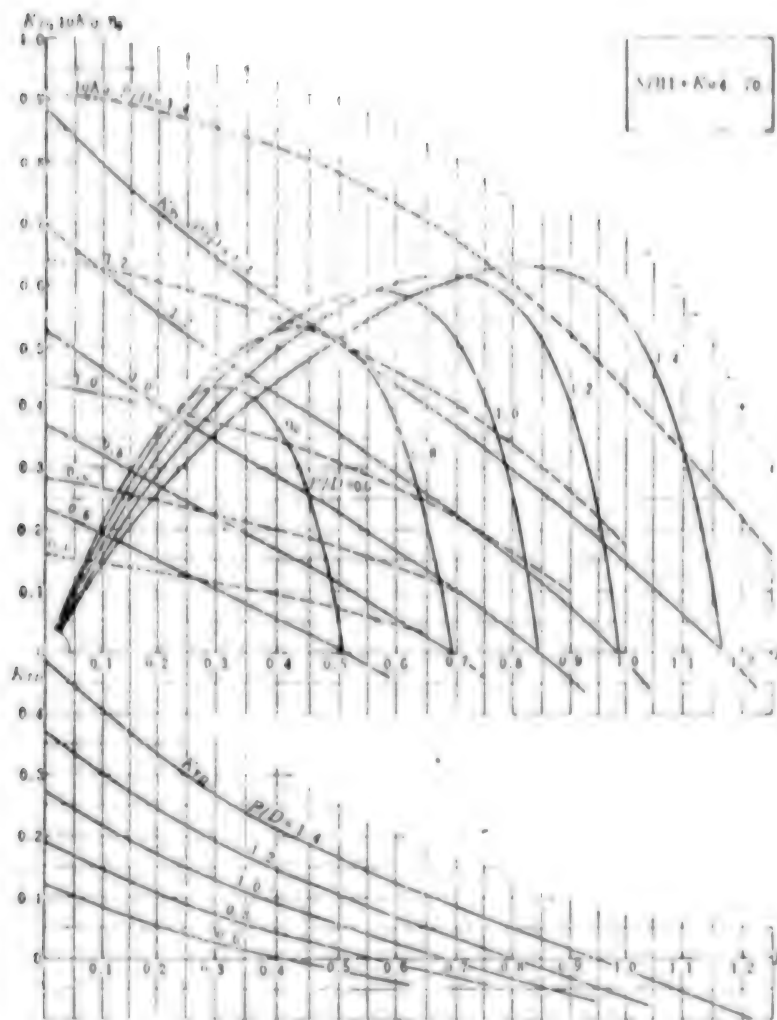


Figure 36. K_T - K_Q - J open-water curves for $SD11+Ka4=70$

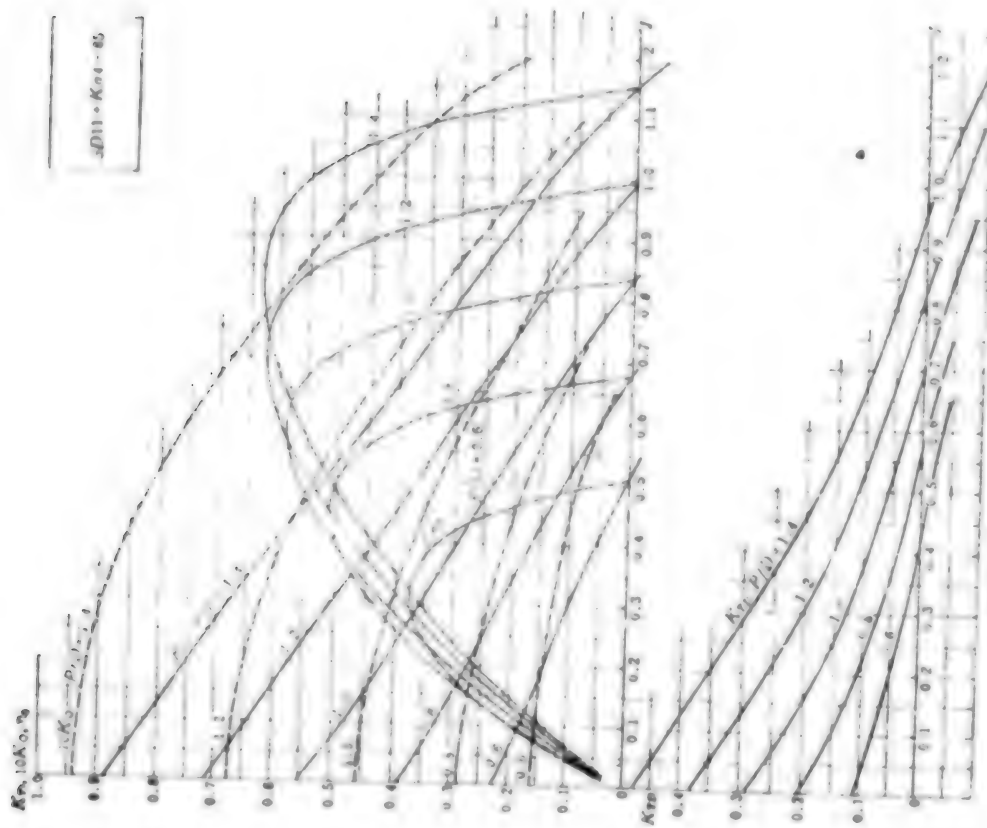


Figure 37. K_T - K_Q -J open water curves for SD11 + Ka4-85

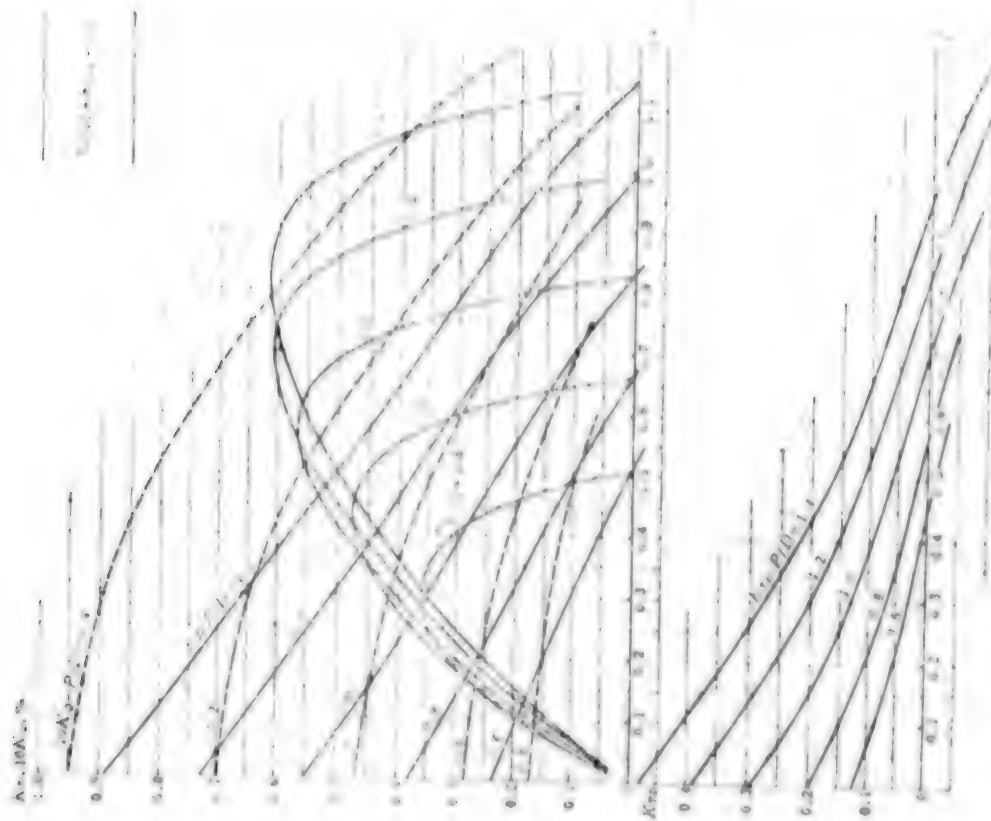


Figure 38. K_T - K_Q -J open water curves for SD11 + Ka4-100

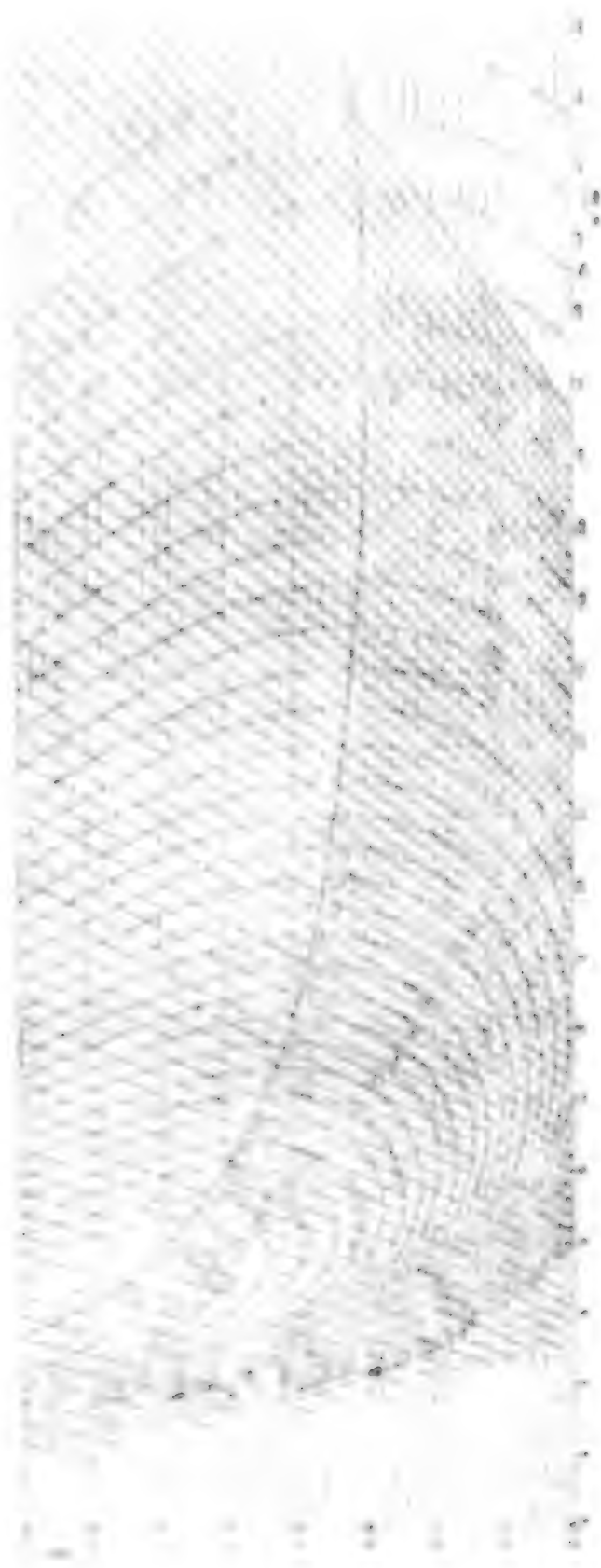


Figure 10. $\sqrt{p} \sim t$ design curves for SD11 + K25-70

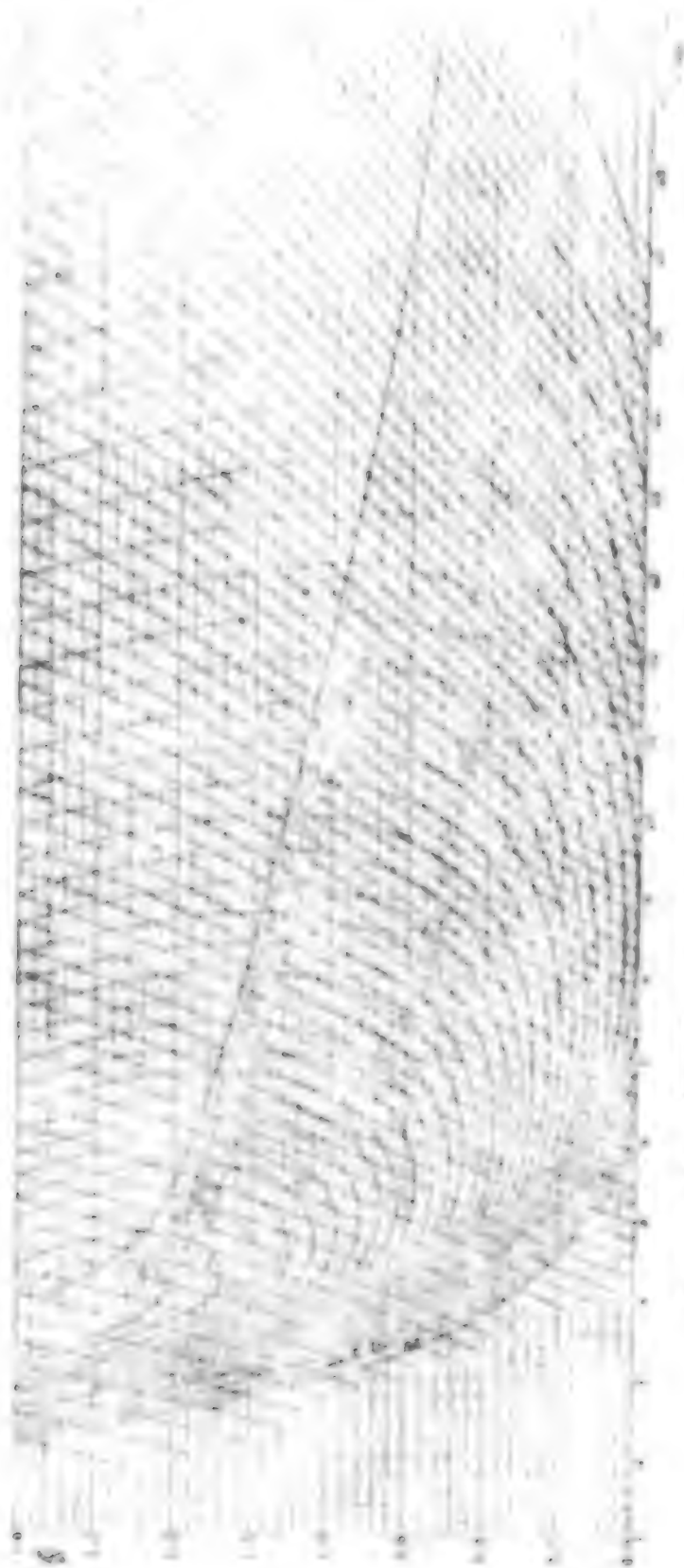


Figure 41. $\sqrt{B_p}$ design curves for SD11 + KJL-100

7. Symbols

1. Symbols

$\frac{A_2}{A_1}$	Disk area ratio
$K_1 = \frac{K_1 V_1^{1/3}}{V_1^{1/3}} = \frac{K_1 V_1^{1/3}}{V_1^{1/3}}$	Design coefficient
$K_2 = \frac{K_2 V_2^{1/3}}{V_2^{1/3}} = \frac{K_2 V_2^{1/3}}{V_2^{1/3}}$	Design coefficient
$C_1 = \frac{T}{\frac{1}{2} \rho V_1^2 A_1} = \frac{K_1}{J^2}$	Thrust loading coefficient
$C_{11} = \frac{T_1}{\frac{1}{2} \rho V_1^2 A_1} = \frac{K_1}{J^2}$	Propeller loading coefficient
$C_{12} = \frac{T_2}{\frac{1}{2} \rho V_2^2 A_2} = \frac{K_2}{J^2}$	Total thrust loading coefficient
$C_2 = \frac{T_2}{\frac{1}{2} \rho V_2^2 A_2} = \frac{K_2}{J^2}$	Power loading coefficient
$J = \frac{V_1}{a_1}$	Advance coefficient
$K_1 = \frac{T_1}{\rho a_1^3 J^2}$	Duct thrust coefficient
$K_2 = \frac{T_2}{\rho a_2^3 J^2}$	Propeller thrust coefficient
$K_{12} = \frac{T_2}{\rho a_2^3 J^2}$	Total thrust coefficient
$K_3 = \frac{Q}{\rho a_1^3 J^2}$	Torque coefficient
C_{p1}	Duct surface pressure coefficient
c	Blade section chord
D	Propeller diameter
D_{max}	Maximum external diameter of duct
f/l	Maximum arch ratio
L_1	Distance from propeller disk surface to duct leading edge
L	Total duct length
L/D	Length-to-diameter ratio
l	Length of main duct

l	Length of secondary duct
n	Revolutions per second
N	Revolutions per minute
P/D	Propeller pitch ratio
P_h	Delivered horsepower (metric)
Q	Torque
Re	Reynolds number
T_s	Duct thrust
T_p	Propeller thrust
T_t	Total thrust
t/l	Maximum thickness ratio
P_t	Thrust horsepower (metric)
V_a	Advance speed (m/sec)
V_s	Advance speed (knots)
\angle	
α	Angle between duct section transverse line and propeller axis
α_s	Turn angle of secondary duct
$a_c = \frac{\text{Area of duct opening}}{\text{Area of duct throat}}$	Leading edge contraction coefficient
$a_t = \frac{\text{Area of duct outlet}}{\text{Area of duct throat}}$	Trailing edge diffusion coefficient
τ	Tail diffusion angle
$\lambda = \frac{ND}{V_s} = \frac{10.49}{J}$	Speed ratio
$\lambda^* = \frac{ND_s}{V_s} = \frac{D_s}{D} \lambda$	Speed ratio
λ	Tip gap
λ/D	Tip gap ratio
$\eta = \frac{(V_s/V_a)^{1/2}}{K_a}$	Efficiency coefficient
$\eta_i = \frac{2}{1 + \sqrt{1 + C_{D0}}}$	Ideal efficiency of ducted propeller
$\eta = \frac{J}{2\lambda} \frac{K_p}{K_a}$	Actual efficiency of ducted propeller
σ	Slenderness

$\tau = \frac{T_P}{T_T}$ Thrust ratio (ratio of propeller thrust to total thrust)

2. Subscripts

D	Duct
max	maximum
opt	optimum
P	Propeller
S	Separation point
T	Total (duct-propeller combination)

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

CHINESE ACADEMY OF SCIENCES HOLDS ACADEMIC DEPARTMENT MEETING

Beijing GUANGMING RIBAO in Chinese 6 Apr 80 p 1

[Text] The plenary session of the Academic Department Committee of the Chinese Academy of Sciences was held in Beijing 28 March to 2 April. The functions and tasks of the Academic Department under the new conditions have been voted at the meeting. In addition to studying the problem of increasing the committee members of the department, the meeting nominated 378 candidates for the coming election of the Academic Department committee members.

The charter draft of the Academic Department of Chinese Academy of Sciences discussed at the meeting specifies that after the meeting, the main tasks of the Academic Department will be to exercise leadership over the academic activities of the Chinese Academy of Sciences and to provide advisory and consulting services to solve major scientific and technological problems and policy problems concerning China's modernization programs.

The Academic Department of the Chinese Academy of Sciences was established in 1955. Disruptions by Lin Biao and the "gang of four" stopped the Academic Department from functioning for more than 10 years. This is the first plenary meeting since the Academic Department resumed its activities.

When the Academic Department was established in 1955, it had 190 committee members. Both the quantity and accomplishment reflected the academic level of various scientific disciplines of our country at that time. Now, after more than 20 years, more than 70 members, or more than one-third of the committee members have died. As science and technology keep developing, new scientific subjects and technologies emerge continuously. The gigantic projects of our country's four modernizations also require new and advanced scientific and technological services. During the past 20 plus years, significant progress and many changes have taken place among our scientific and technological personnel forces. Thus, the size of the committee and the fields they represent are not adapted to the trend of the development. Last July, with the approval of state council, the Chinese Academy of Sciences decided to increase the number of committee members of the Academic Department to reinforce the department with outstanding scientists and new

comers in the field of science and technology so that they may play fully the role of scientists and help academic leadership. In keeping with the decision, the incumbent committee members, the various departments, provinces, municipalities, autonomous regions, and various specialized societies have done a tremendous job in recommending and selecting candidates for election to the membership of the committee.

9594

CSO: 4008

SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

NEW INSTITUTE ESTABLISHED IN SICHUAN UNIVERSITY

Beijing GUANGMING RIBAO in Chinese 7 Apr 80 p 2

[Article by Qiu Peihuang [6726 3099 4635]: "Sichuan University Establishes Institute of Atomic Nucleus Science and Technology"]

[Text] The Institute of Atomic Nuclear Science and Technology [Yuanzihe Kexue Jishu Yanjiusuo 0626 0311 2702 4430 1331 5890 4282 4496 2076] of Sichuan University is working hard to install and adjust its test equipment. Some of them are already in test runs. The major construction work of this institute began in 1973. As of now, the construction of sites and the assembly of accessories of several accelerators have been basically completed. Some of the assembled and tested accelerators are already in test runs. Sichuan University cooperated with ten or more other units in these test runs. They have explored the application of some nuclear technology, studied frontier sciences, and scored certain achievements.

9586

CS01 41885

SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

BIOMEDICAL COMMITTEE ESTABLISHED IN JIAOTONG UNIVERSITY

Beijing GUANGMING RIBAO in Chinese 7 Apr 80 p 2

[Article by Zhen Yifang [7115 6318 5364]: "Shanghai Jiaotong University Establishes Biomedical Engineering Committee"]

[Text] To meet the need of the development of scientific technology, the Shanghai Jiaotong University has established a Biomedical Engineering Committee. Biomedical engineering is a new field of study. In the recent 2-3 years, the Shanghai Jiaotong University cooperating with the Shanghai First Medical College, has done some preliminary research in certain area of biomedical engineering. Six departments of this university have already scored initial successes in research activities covering the field of the human body, powered artificial limbs and robot, biological fluid mechanics, artificial mental faculties and microwave treatment of cancer. The committee has decided that the research work shall emphasize five different fields, namely biological mechanics which includes fluid mechanics of heart vessels; the mechanics of bone fracture and structure; biomedical engineering which includes biomedical instruments, the treatment of biomedical information, human body field research. microwave treatment of cancer; artificial mental faculties; sense organs; biological energetics.

9594

CSO: 4008

Microbiology

AUTHOR: DENG Yuxiu [6772 1342 4423]
YAN Xunchu [7051 6676 0443]

ORG: Institute of Microbiology, Chinese Academy of Sciences, Beijing

TITLE: "Studies on the Paucisporaceae 1. A New Species of *Microtetraspora*"

SOURCE: Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese
Vol 19, No 1, Mar 79 pp 1-4

TEXT OF ENGLISH ABSTRACT:

A strain of actinomycete no. 75-3 belonging to the family of Paucisporaceae, was isolated from a soil sample collected in Xizang Zizhiqu, China. This strain produces a filamentous growth differentiated into a vegetative and an aerial mycelium. The short and sparsely branched aerial mycelium bears at the end of short sporophores chains of four spores.

Sporulation is not observed on the vegetative mycelium. The chemical composition of cell wall belongs to type III. All these characteristics are conformable to those of *Microtetraspora*. But this strain is different from other species of the genus in cultural characteristics and physiological properties. It, therefore, is considered to be a new species and named as

[Continuation of WEISHENGWU XUEBAO Vol 19, No 1, Mar 79 pp 1-4]

***Microtetraspora incanescens* n. sp.**
and has the following morphological and cultural characteristics on synthetic and organic media.

	Surface of spore	Substrate mycelium	Aerial mycelium	Soluble pigment
Glycerol		Pale Ochraceous	Pinkish White	Antimony Yellow*
Asparagine agar				to Apricot Yellow*
Calcium malate agar		Medal Bronze*	Greyish White	None
Nutrient agar		Near color of medium	White	Color of medium
Optimal agar	Rugose with little Asperities	Colorless	White to Greyish White	Tint of Yellow or none

* Ridgway, R.: Color Standards and Color Nomenclature, 1912.

Received 17 January 1978.

AUTHOR: CHEN Liren [7115 4409 0088]
CHEN Huiqin [7115 1920 0530]
YAN Rulian [7346 1172 5571]

ORG: All of the Guangxi Academy of Agricultural Sciences, Nanning

TITLE: "An Antiblast Antibiotic 891 I. Taxonomy of *Streptomyces*
Longshengensis N. Sp."

SOURCE: Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese
Vol 19, No 1, Mar 79 pp 5-10

TEXT OF ENGLISH ABSTRACT:

A Strain of *Streptomyces* No. 891 was isolated from the soil of Longsheng county, Guangxi. It was cultured on various agar media, the aerial mycelia white to lightly gray, substrate mycelia lightly white to yellowish, no melanoid pigments, the sporechains are spiral, the spores are elliptical with

spiny surface. According to the morphological, cultural and biochemical characteristics, it differs from every species of *Streptomyces* described in the literature. So that, No. 891 was identified as a new species *Streptomyces longshengensis* n. sp. Yan et al.

[Continuation of WEISHENGWU XUEBAO Vol 19, No 1, Mar 79 pp 5-10]

Colleague LI Saizhen [2621 6357 8091] took part in some of the work. YAN Xunchu [7051 6676 0443] and ZHANG Guowei [1728 0948 0251] of the Microbiology Institute of Chinese Academy of Sciences, identified the species. The electron microphotographs were taken by the Electron Microscope Office, Institute of Biophysics.

Received 13 January 1978.

AUTHOR: YU Yongnian [0151 3057 1628]
LAI Yiqi [6351 1150 3825]

ORG: Both of the Institute of Microbiology, Chinese Academy of Sciences,
Beijing

TITLE: "Taxonomic Studies on the Genus *Phyllactinia* of China II. *Phyllactinia*
With Short Perithecial Appendages"

SOURCE: Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese
Vol 19, No 1, Mar 79 pp 11-23

TEXT OF ENGLISH ABSTRACT:

Fifteen species of Chinese *Phyllactinia* with short perithecial appendages are described. The length of their perithecial appendages is about 1-1.5 times as long as the diameter of the perithecium. Among which two are new combinations (states) and six new species,

namely: *Phyllactinia ailanthi* (Golov. et Bunk.) Yu stat. nov., *Ph. populi* (Jacz.) Yu stat. nov., *Ph. aleuritidis* Yu et Lai sp. nov., *Ph. alni* Yu et Han sp. nov., *Ph. ampelopsidis* Yu et Lai sp. nov., *Ph. magnoliae* Yu et Lai sp. nov., *Ph. paulowniae* Yu sp. nov. and *Ph. sinensis* Yu sp. nov. Differences between

[Continuation of WEISHENGWU XUEBAO Vol 19, No 1, Mar 79 pp 11-23]

the fifteen species and their closely related species are discussed. The synonyms of each species and its geographical distribution in China are also given. Type specimens of the six new species are deposited in the Herbarium Mycologicum, Academia Sinica, Beijing, China.

HAN Shulin [7281 2885 6855] took part in some of the work. WEI Jiangchun [7614 3068 2304] revised the Latin terms. HAN Zhefang [7281 0772 5364] and JIAN Li [46755408] traced the drawings.

Received 24 November 1977.

AUTHOR: LU Yanyu [4151 6663 3768]
YAN Xunchu [7346 6676 0443]

ORG: Both of the Institute of Microbiology, Chinese Academy of Sciences, Beijing

TITLE: "Electronic Microscopic Examination of Spore Surface Structure in Three *Streptomyces* Groups"

SOURCE: Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 19, No 1, Mar 79 pp 24-26

TEXT OF ENGLISH ABSTRACT:

The spores of type strains of 11 new species and 4 new varieties of three *Streptomyces* groups published in 1962-1965 are examined under electronmicroscope.

They show:

1. In *Glaucus* group, the surface of spores in spiral chain is spiny; that in *rectiflexibilis* section is smooth.

2. In *Lavendulae* group, the spore surface is smooth.

3. In *Aureus* group the surface structure of spores show great diversity: smooth, rugose, spiny, or hairy.

4. The ornamentation of a spore begins to appear on the surface of the spore chain before the formation of spores (*Streptomyces griseocitreus*).

[Continuation of WEISHENGWU XUEBAO Vol 19, No 1, Mar 79 pp 24-26]

The electron microphotographs were taken by the Electron Microscope Office, Institute of Biophysics, Chinese Academy of Sciences.

Received 16 December 1977.

AUTHOR: CHEN, Jianxin [1156 1131 0361]
GU, Shizhen [0702 3012 1337]
GU, Wenqi [1141 2629 0706]
ZHANG, Shizhen [0102 3319 3701]
WANG, Jinglong [5002 0366 1730]

ORIG: All of the Institute of Microbiology, Chinese Academy of Sciences, Beijing

TITLE: "Preliminary Studies on the Isolation of the mRNA for TMV-coat Protein and the Analysis of its *In Vitro* Translation Products"

SOURCE: Beijing WEIJIENGMU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 19, No 1, Mar 79 pp 34-40

TEXT OF ENGLISH ABSTRACT:

Total RNA had been extracted from tobacco leaves infected by TMV common strain and fractionated into seven fractions by Sepharose 6B gel chromatography.

The distribution of various kinds of RNAs was examined by gel electrophoresis. A quite strong radioactive band with the same electrophoretic mobility as (¹⁴C)-labeled coat protein was synthesized in

[Continuation of WEIJIENGMU XUEBAO Vol 19, No 1, Mar 79 pp 34-40]

the wheat embryo cell-free translation provided with (¹⁴C)-protein hydrolyzate and programmed with the total RNA from TMV-infected leaves or the RNA of fraction IV obtained after chromatography, but not in the translation programmed with virus RNA or formaldehyde-treated virus RNA. This radioactive band was not seen in fluorogram under the same conditions when the (¹⁴C)-protein hydrolyzate was substituted by (³H)-His. Thus

we concluded that such radioactive band is the newly synthesized TMV-coat protein.

The gel electrophoretic patterns have shown that fraction IV contains the expected low molecular weight RNAs in each RNA₁ and RNA₂, probably corresponding to the LHR reported previously. It is more worthy that the two bands RNA₁ and RNA₂ become seven bands as the RNAs of the fraction IV from infected leaves were separated by gel electrophoresis with a discontinuous sucrose gradient (3% and 4.5%). So the LHR region might be a complex multicomponent one. As to which band is the real mRNA for TMV-coat protein remains to be studied.

AUTHOR: BA Shou-ao [0719 9219 2400]
BI Jing [1750 2502]
FU Rong-ao [0131 5389 2400]

ORIG: All of the Institute of Microbiology, Chinese Academy of Sciences, Beijing

TITLE: "Isolation and Properties of Deoxyribonucleic Acids from Phages Attacking *Corynebacterium Pekinese*"

SOURCE: Beijing WEISHENG XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 19, No 1, Mar 79 pp 41-44

TEXT OF ENGLISH ABSTRACT:

Deoxyribonucleic acids were isolated by phenol extraction from three serotypes of bacteriophage — A1, A2 and A1B3 on *Corynebacterium pekinense*.

DNAs isolated from these phages contained only four usual bases, i.e. adenine, guanine, cytosine and thymine. The mole per cent G.C. of these DNAs were determined by thermal denaturation

[Continuation of WEISHENG XUEBAO Vol 19, No 1, Mar 79 pp 41-44]

method and the values for A1, A2 and A1B3 calculated by Doty's equation were 61.2, 64.6 and 67.5% respectively.

It was proved that all these phage

DNAs were connected with glucose residues. These extracted DNAs were found to be able to infect protoplast prepared by treatment of *Aspergillus niger* with α -methyl

Received 24 March 1979.

AUTHORS: YAO Mangqing [7051 2768 2494]
CAI Bolla [1791 1793 7207]
WANG Qian [1769 4486 2429]
GAO Yuesheng [7159 1131 6382]
ZHANG Bolla [1728 1920 1829]
LI Bing [7421 0130 0730]

ORG: YAO, CAI and WANG of the Department of Biology, Shandong University
Jinan, GAO, ZHANG and LI of the Laboratory of Electron Microscope, Shandong
Medical College, Jinan

TITLE: "Morphological Observations of Bacteriophages of *Bacillus Thuringiensis*
and the Development of Phase GP-10 in Bacterial Host Cells"

SOURCE: Beijing WEISHENGXUE JICHUAN [ACTA MICROBIOLOGICA SINICA] in Chinese
Vol 19, No 1, Mar 79 pp 45-51

TEXT OF ENGLISH ABSTRACT:

10 isolates of bacteriophages of
Bacillus thuringiensis were obtained from
the working environment and phage-
types of fermentative tanks in Biological

and Experimental Pathology of Shandong
University in the past five years. Analysis
of host range was made by using 15
strains of *Bacillus thuringiensis* belonging

[Continuation of WEISHENGXUE JICHUAN Vol 19, No 1, Mar 79 pp 45-51]

to 9 standard serotypes. Morphological
observations were carried out under
electronmicroscopy. According to the
classification system for bacteriophages
issued by International Committee on
Nomenclature of Viruses (ICNV), the
bacteriophages mentioned above are classi-
fied in morphological terms into 3 groups.

A strain of *Bacillus thuringiensis* var.
galeries was infected with specific phage
GP-10. Ultrathinsections of infected bac-
terial cells were made and examined under
electronmicroscopy. After adsorption of
the phage particles on bacterial cell wall
and penetration of phage nucleic acid, the

first sign of phage multiplication is seen
in the nucleus is the enlargement of the
nucleoid area. As the phage particles are
being assembled, electron dense particles
with hexagonal profile appear first in the
nucleoid areas. They increase then in
number and the distended nucleoid areas
are eventually full of regularly arranged
phage particles. At the final stage of
multiplication, the mature phage particles
are released into the surroundings due to
the burst of the cell wall, and the ghost of
the bacterial cell wall is left behind. It
is estimated that there are about 1,000
phage particles per cell.

Received 13 December 1977.

AUTHORS: B18 Rao [0210 9185]
Li Shulan [2621 2805 5695]
Li Weiqi [2621 6850 3825]
Ni Shi [1441 3097]
Li Fushen [2621 1768 6297]

ORIGINS: B18 and Li Shulan of The Agricultural Institute of Wujiaqu, Xinjiang Uygur Autonomous Region, Wujiaqu, Li Weiqi, Ni and Li Fushen of The Chemical Institute of Xinjiang Uygur Autonomous Region, Urumqi

TITLE: "A Preliminary Study of Cauliflower Mosaic Virus Strain 63-3"

SOURCE: Beijing WEISHENGLI XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 19, No 1, Mar 79 pp 52-56

TEXT OF ENGLISH ABSTRACT:

A virus strain 63-3 was isolated from *Brassica oleracea* var. capitata in the year 1963, T. D. P. 15-20°C, D. R. P. 1: 1000-5000, incubating in vitro 5-14 days, host range within the limits of cruciferous

plants. This isolate is therefore identified as a strain of the cauliflower mosaic virus. On *B. oleracea* var. capitata, the symptom is at first vein-clearing, then mosaic. The main symptom on *B. oleracea* var. botrytis is vein-clearing. In addition to the vein-

[Continuation of WEISHENGLI XUEBAO Vol 19, No 1, Mar 79 pp 52-56]

clearing symptom, necrotic streaks appear also on the leaves of *B. pekinensis* and *Raphanus sativus*. Viral particles are spherical, 30 nm in diameter. Vectors are *Myzus persicae* and *Brassicae brassicae*.

Recent serological studies indicate that there is no cross-protection and antigenic relationship between 63-3 isolate, turnip mosaic and *Raphanus sativus* virus.

Wu Jichang [5170 0879 2032] was consulted in the biological determination. ZHOU Jiarui [0719 1267 3389] and TIAN Bo [3944 3136] revised the draft.

Received 20 December 1977.

AUTHOR: XIANG Fuying [0080 1189 5391]
WU Xianmei [1163 2516 2734]
ZHANG Jingshou [0392 4842 0719]

ORIG: XIANG and WU of the Institute of Forest Science, Academy of Forest Science, Beijing, ZHANG of the Heilongjiang Institute of Forest Protect, Heilongjiang

TITLE: "The Identification of the Causal Organism of the Blister-Type Canker on Poplar"

SOURCE: Beijing WEICHENGJI SHUBAO [ACTA MYCOPHYLOGICA SINICA] in Chinese Vol 19, No 1, Mar 79 pp 57-63

TEXT OF ENGLISH ABSTRACT:

A fungus isolated from the blister-type canker on poplar has succeeded in inoculation both in laboratory or in the field tests. Repeated inoculations on poplar with different bacterial inoculum isolated from the same patches are failed.

The perfect stage of the fungus has identified as *Botryosphaeria dothidea*; strains 3-7 was in diameter; average $114.0-178.0 \times 175.0-280.0 \mu\text{m}$; and $69.0-88.0 \times 11.0-21.0 \mu\text{m}$; anastomose 1-

[Continuation of WEICHENGJI SHUBAO Vol 19, No 1, Mar 79 pp 57-63]

celled, hyaline, obovoid, $15.0-19.4 \times 7.0-11.0 \mu\text{m}$. The imperfect stage of the fungus is *Dothidea populi*; conidia 1-celled, hyaline, oval to fusoid, $15.4-20.1 \times 5.1-6.6 \mu\text{m}$ in dia.

The bacteria isolated from the patches have identified as *Brevia* and *Pseudomonas*. Since they do not produce necrosis in the reaction tests, they are assumed as saprophytes rather than parasites.

Professor WU Daxian [0001 1179 4846] was consulted in the research.

Received 18 March 1978.

AUTHOR: None

ORIG: Institute of Forestry and Pedology, Chinese Academy of Sciences, Shenyang Organic Chemical Factory

TITLE: "Studies on the Fermentation of Sebacic Acid from n-Decane by *Candida Lipolytica*"

SOURCE: Beijing WEISHENGXUE XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 19, No 1, Mar 79 pp 64-70

TEXT OF ENGLISH ABSTRACT:

A strain of yeast which can produce sebatic acid from n-decane was selected out from many microorganisms isolated from the oil seeds, flowers, and fruits. It was identified as *Candida lipolytica*.

Fermentation conditions for the whole

bulk production of sebatic acid by *Candida lipolytica* strain C₁₀, were investigated. After 96 hr of fermentation in a medium containing n-decane, sodium acetate, urea, potassium dihydrogen phosphate and corn steep liquor, the yields of

[Continuation of WEISHENGXUE XUEBAO Vol 19, No 1, Mar 79 pp 64-70]

sebatic acid were 33-40 g/l (conversion rate 43-55%).

The suitable nitrogen source is urea. Corn steep liquor is necessary for acid production. The suitable pH range is between 7.2-7.7. Besides, the rate of aeration, the final pH, and the age and

amount of inoculum also have great effects on the production.

Fermentation experiments have been conducted in 500 l fermentor and the acid production was stable.

Received 10 December 1977.

AUTHOR: None

ORG: Research Group of Hydrocarbon Metabolism and Fermentation Workshop,
Institute of Microbiology, Chinese Academy of Sciences

TITLE: "Studies on the Fermentation of Long-Chain Dicarboxylic Acids"

SOURCE: Beijing, WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese
Vol 19, No 1, Mar 79 pp 7-15

TEXT OF ENGLISH ABSTRACT:

A mutant U_{1-2} was derived from *Candida tropicalis* No. 128. Fermenting cells of strain U_{1-2} produced dicarboxylic acids corresponding with carbon chain length from various individual n-alkanes (C_{10} -

C_{20}) and with high yields of 400-450%, except DC_{12} and DC_{14} . The crude products were 80-90% in purity. Therefore, the strain U_{1-2} may be a good producer

Received 20 July 1976.

AUTHOR: FANG Jinxian [2455 4480 1629]
WU Jiachang [5478 1367 2906]
HU Yulin [5170 3748 7792]

ORG: All of the Institute of Materia Medica, Chinese Academy of Sciences, Shanghai

TITLE: "Adustin, a New Antifungal Antibiotic II. The Chemical Structure and Chemical Synthesis"

SOURCE: Beijing, WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese
Vol 19, No 1, Mar 79 pp 76-80

TEXT OF ENGLISH ABSTRACT:

Adustin, a new antifungal antibiotic has been isolated from mycelium of *Streptomyces albidus* (Nobis) Dudgeon. Its structure, depicted as 2-benzoyl-3-hydroxy

form, has been elucidated on the basis of spectroscopic evidence and total synthesis.

Received 4 October 1977.

AUTHOR: TU Qiwu [0000 0386 0251]
GANG Nanjin [3769 0589 6855]
TIAN Jie [3944 3381]
YAN Guhua [7051 2710 5478]
WINE Xuying [2494 4423 5391]
JIN Lianfeng [6855 5571 5302]
LI Qian [2621 5409]
ZHANG Jiamu [1728 1367 5019]

ORG: All of the Antibiotics Research Laboratory, Institute of Materia Medica, Chinese Academy of Medical Sciences, Beijing

TITLE: "Streptomyces Strain 1043 and Actinospectacin Produced By It"

SOURCE: Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 19, No 1, Mar 79 pp 81-87

TEXT OF ENGLISH ABSTRACT:

Streptomyces strain 1043 was isolated from a soil sample collected in Hengshui.	viridis and the other as Actinospectacin, a water soluble basic antibiotic.
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[Continuation of WEISHENGWU XUEBAO Vol 19, No 1, Mar 79 pp 81-87]

Actinospectacin is a broad spectrum antimicrobial agent. It was more effective against *Diplococcus pneumoniae*, *Staphylococcus aureus*, *Escherichia coli*, *Staphylococcus pneumoniae* in mice, which were infected intraperitoneally.

Its morphological, cultural and physiological characteristics were found to resemble closely those of *St. griseus*.

Two antibiotics were isolated from the fermentation broth of *Streptomyces* 1043. Based on their physicochemical properties, one was identified as *Strepto-*

Received 9 January 1979.

AUTHOR: GAO Nixian [1559 2406 2450]
Li Yuhua [2621 3798 3478]
Bai Shunshun [7281 3219 2406]
CHEN Zhongren [7115 2473 0068]

ORG: All of the National Vaccine and Serum Institute, Beijing

TITLE: "Continuous Culture of *Plasmodium falciparum* in Vitro After Being Kept in Deep-Freeze"

SOURCE: Beijing WEISHENGJI XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol. 19, No. 1, Mar 79 pp 88-90

TEXT OF ENGLISH ABSTRACT:

After having succeeded in growing *Plasmodium falciparum* in vitro for over 100 days, attempt to cultivate human malarial parasite, *P. falciparum*, in vitro was also made. So far, it is possible to carry the culture for 70 days. Infected blood was taken from a patient and was

kept in deep freeze after the addition of glucose-glycerine as the protective agent at -180°C . Before culture, blood kept in frozen suspension, was removed from liquid nitrogen and quickly thawed. The technique used for the culture of *P. falciparum* was employed. In order to avoid hemolysis of the preserved blood

[Continuation of WEISHENGJI XUEBAO Vol. 19, No. 1, Mar 79 pp 88-90]

cells, high concentration of glucose was added and cultivated in a dialysis apparatus. After that, the blood sample was transferred to Reheimsayer flasks and cultured in the presence of CO_2 in a modified incubator at 37°C . Medium was replaced daily with the addition of fresh defibrinated human blood every 2 to 3 days. It was found that all erythrocytic stages of the *P. falciparum* could be observed and when the growth conditions were not very favorable, some gametocytes were also seen. Factors relating to the in vitro culture of human plasmodium were discussed.

Received 18 July 1978.

AUTHORS: CHEN Liangtao [7115 5328 2871]
WANG Jianshan [3789 6015 0389]
HONG Tao [3163 3447]

ORG: CHEN of the General Hospital, Beijing Military Region; WANG and HONG of the Institute of Virology, Chinese Academy of Medical Sciences, Beijing

TITLE: "Immunoperoxidase Technique and Its Application to the Intracellular Localization of Parainfluenza Virus (Sendai Strain)"

SOURCE: Beijing WEISHENGXUE JOURNAL [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 19, No 1, Mar 79 pp 91-95

TEXT OF ENGLISH ABSTRACT:

The immunoperoxidase technique for the electron and light microscopic examination was used for the intracellular localization of the Sendai strain of parainfluenza virus. Frozen section preparations of lungs of Swiss mice and

monolayer cell cultures of human embryonic kidneys infected with the virus served as materials for study. It was found that in the cytoplasmic membranes, the cytoplasm of the bronchiolar and alveolar cells, as well as the budding virus were positively stained.

[Continuation of WEISHENGXUE JOURNAL Vol 19, No 1, Mar 79 pp 91-95]

The following problems were discussed: the specificity of the results obtained; the problems of immunoperoxidase technique with regard to the fixation with the antigen, and the coupling of the enzyme with the immunoglobulin; as well as the difficulty of the penetration of the labeled immunoglobulin into the infected cells.

Received 23 January 1978.

AUTHOR: YANG Guanglai [1179 1585 1161]
GU Shuhua [0719 1119 1478]
YANG Bingbo [2709 7410 6636]
WU Fushu [0160 1061 1191]
FU QiuLin [0191 6628 7611]

ORG: All of the Institute of Epidemiology Chinese Academy of Medical Sciences, Beijing

TITLE: "A Study on the Interferon From Human Umbilical Cord Blood II. Comparison of Purification Methods of Interferon and Preliminary Study of Its Characteristics"

SOURCE: Beijing WEISHENGXUE JIJIAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol. 19, No. 1, Mar 79 pp 96-103

TEXT OF ENGLISH ABSTRACT:

A comparative study on the methods for the purification of interferon from human umbilical cord blood has been carried out. The methods studied were the salting out by potassium thiocyanate,

the chemical salting out by ammonium sulfate, mixed salting out procedures, direct ultracentrifugation and ion exchange chromatography. The first two methods were found to be more preferable as they possess the following advantages:

[Continuation of WEISHENGXUE JIJIAO Vol. 19, No. 1, Mar 79 pp 96-103]

simplicity in the preparation of specimens under study, time saving, higher yields of purified interferon, and higher specific activities. By means of these two methods, the specific activities of the final products

were increased to $3-6 \times 10^6$ units/mg protein and $1-1.4 \times 10^6$ units/mg protein respectively. Preliminary characterization indicated that human cord blood interferon is a glycoprotein with a molecular weight of 20,000.

Received 28 November 1977.

AUTHOR: SHI Guohong [2457 5096 4563]
DING Xiangguang [0002 2556 0342]
YING Baibei [2019 5563 5563]

ORG: All of the Sanitary and Anti-Epidemic Station of Shanghai

TITLE: "An Investigation on the Etiology of Epidemic Myalgia (Pleurodynia) in the Rural Districts of Shanghai"

SOURCE: Beijing WEISHENGXUE JIYUAN [ACTA MICROBIOLOGICA SINICA] in Chinese
Vol 19, No 1, Mar 79 pp 104-108

TEXT OF ENGLISH ABSTRACT:

From July to September in 1975, an epidemic myalgia (pleurodynia) broke out in certain districts in the counties of Baoshan and Jiding. 26 strains of coxsackie B₄ virus were isolated from rectal swabs, throat swabings and stool specimens taken from 27 patients. The

results of neutralization test using paired sera from 9 patients, and convalescent serum from 3 cases against the recently isolated virus antigen (BMT-8) showed that the titre of the convalescent sera of 9 cases showed a four fold rise or was higher than those of the acute stage and the G. M. T. of the convalescent sera was

[Continuation of WEISHENGXUE JIYUAN Vol 19, No 1, Mar 79 pp 104-108]

42 times higher than that of the acute stage. The virologic and serologic results demonstrated that coxsackie B₄ virus was the etiologic agent of the epidemic myalgia (pleurodynia) in 1975 in Shanghai.

Received 13 December 1977.

CBO: 4009

AUTHOR: GU LINGRAN [ISSN: 5114 (2017)]

ORG: Mathematics Department

TITLE: "The Asymptotic Behavior of the Solution of Initial Value Problem for Parabolic Equation with Discontinuous Coefficients"

SOURCE: XIJIN XUEBEN DAXUE XUEBAO—JINAN XUEBEN DAXUE [JOURNAL OF XIJIN UNIVERSITY—NATURAL SCIENCES EDITION] in Chinese No 1, Feb 80 pp 1-11

TEXT OF ENGLISH ABSTRACT: In this paper we consider the asymptotic behavior of the solutions for initial value problem (1) (2) (3) as $t \rightarrow \infty$. Using the method of auxiliary function and maximum principle we obtain the following main theorems:
Theorem 1. Let $u(x, t)$ be the solution of problem (1) (2) (3). Suppose $1 + \alpha_2(x, t) \geq \delta > 0$ ($x = 1, \text{ or } 2$) for $|x| \geq l_0$ ($l_0 > l_0$) and $\lim_{t \rightarrow \infty} \varphi(x) = 0$, then $\lim_{t \rightarrow \infty} u(x, t) = 0$ uniformly in x .

Theorem 2. Let $u(x, t)$ be the solution of problem (1) (2) (3). Suppose $\lim_{t \rightarrow \infty} \alpha_1(x, t) = a_1^*$, $1 + \alpha_2(x, t) \geq \delta > 0$ for $|x| \geq l_0$ ($l_0 > l_0$), and $\alpha_3(x, t) = \frac{1}{t}$, $c_3(x, t) = 0$, if $\lim_{t \rightarrow \infty} \varphi(x) = a_1^*$, then

$$\lim_{t \rightarrow \infty} u(x, t) = \frac{a_1^* \alpha_1(x, t) + \alpha_2(x, t) + \alpha_3(x, t)}{a_1^* \alpha_1(x, t) + \alpha_2(x, t) + \alpha_3(x, t)}$$

[Continuation of XIJIN DAXUE XUEBAO—JINAN XUEBEN DAXUE No 1, Feb 80 pp 1-11]

uniformly in x ($l_0 \leq x \leq l_0$), where $a_1^* = \lim_{t \rightarrow \infty} \alpha_1(l_0, t)$ and $a_2^* = \lim_{t \rightarrow \infty} \alpha_2(l_0, t)$.

AUTHOR: ZHONG Fuyuan [1903 0001 1795]

ORIG: Mathematics Department

TITLE: "The Inverse Formulas of Singular Integrals on Smooth Orientable Manifolds"

SOURCE: XIAOEN XIAOEN (XIAO XIAOEN)—XIAOEN XIAOEN (JOURNAL OF XIAOEN UNIVERSITY—NATURAL SCIENCES EDITION) in Chinese No 1, Feb 80 pp 12-18

TEXT OF ENGLISH ABSTRACT: In the present paper we derived the inverse formulas of the singular integrals directly from the D. V. Sobolevsky formulas of the Cauchy type integrals with Bochner-Martinelli kernel on the domain bounded by closed smooth orientable manifolds and the topological product of domain with smooth orientable characteristic manifolds.

By the equivalence of composite formulas and inverse formulas, the present paper gives in fact another simple proof of the composite formulas.

AUTHOR: LIN Shengjin [1931 0112 0076]
FENG Hengyi [1936 1307 1308]

ORIG: LIN of the Department of Physics, Xiamen University; FENG of the Department of Physics, Beijing University

TITLE: "Gauge Invariance Problems of the Photon-Photon Scattering Amplitude and the Dimensional Regularization"

SOURCE: XIAOEN XIAOEN (XIAO XIAOEN)—XIAOEN XIAOEN (JOURNAL OF XIAOEN UNIVERSITY—NATURAL SCIENCES EDITION) in Chinese No 1, Feb 80 pp 19-23

TEXT OF ENGLISH ABSTRACT: Using the method of dimensional regularization we have obtained the tensor of lowest order photon-photon scattering amplitude at $\hbar_1\hbar_2\hbar_3\hbar_4$, which is completely in agreement with other regularization techniques.

AUTHOR: QIN Zhuyang [4719 1343 0314]

ORG: Department of Physics

TITLE: "Group Velocities in the Optical Fiber Waveguide and the Shortening of SH Light Pulses"

SOURCE: XIAOYU XIAOYU DAXUE XUEBAO—JINAN XUEYI BAN [JOURNAL OF XIAOYU UNIVERSITY—NATURAL SCIENCES EDITION] in Chinese No 1, Feb 80 pp 24-25

TEXT OF ENGLISH ABSTRACT: The effect of SH light pulses by the group velocity dispersions in the optical fiber waveguide is discussed in this paper. It is possible to obtain the forward traveling anti-stokes ultrashort light pulses of steep-front by means of the anomalous dispersion of group velocity in the single-mode optical fiber waveguide. The analytic expressions and the curves are presented.

AUTHOR: CHEN Jinqun [7119 6835 3123]
CHEN Guang [7119 0340]

ORG: CHEN Jinqun of the Department of Oceanography; CHEN Guang of the Hydrographic Station of Ningbo Region, Fujian

TITLE: "A Dynamic Model for Hourly Predictions of Typhoon Surges along the South-eastern Coast of China"

SOURCE: XIAOYU XIAOYU DAXUE XUEBAO—JINAN XUEYI BAN [JOURNAL OF XIAOYU UNIVERSITY—NATURAL SCIENCES EDITION] in Chinese No 1, Feb 80 pp 32-43

TEXT OF ENGLISH ABSTRACT: A dynamic model has been established for making hourly predictions of typhoon surges along the southeastern coast of China.

The typhoon surge is divided into two parts—the surge caused by low pressure of the typhoon and that caused by wind stress. The former may be considered as long wave caused by moving typhoon pressure. For the latter, we notice the specific characters of this sea area, i.e., its relatively shallow depth of the water, its relatively low latitudes and the relatively slow speed of the typhoon center. By considering these characters, we can obtain a simple model of surge caused by wind stress, where the horizontal component of pressure gradient force is balanced with the horizontal component of frictional force caused by vertical eddy and "quasi-steady state" is

maintained. Besides, this simple model makes it possible for us to use the "whole current method" and give the bottom boundary condition in the form in which fluid velocity is zero, with no need of any subjective supposition of bottom stress, which is a difficulty of the general "whole current method." The computing for making predictions is rather easy. Every meteorological station or tidal station can make predictions independently. The comparisons between the observations and computations of typhoon surges at eight tidal stations (with more than 1,000 items of data) show that the computed values are in good agreement with the observations.

AUTHOR: None

ORG: Acoustic Release Research Group, Department of Oceanography*

TITLE: "A Digital Correlation Receiving Method and Its Application to a Shallow water Release"

SOURCE: XIAPEN DASHI KUEBRO—JIRAN KEREI JAN [JOURNAL OF XIAPEN UNIVERSITY—NATURAL SCIENCES EDITION] in Chansan No 1, Feb 80 pp 44-53

TEXT OF ENGLISH ABSTRACT: This paper describes a digital correlation receiving method using PCM input signals and its application on a shallow water release. It had been proved through a series of field experiments that the correlator has an excellent ability to minimize multipath and fluctuation effect, and can be used to detect weak signals sensibly and reliably under interference background. Thus it gives a simple and reliable method of real-time coherence and real-time detection for a multipath and time-spatial variable acoustic channel, especially for the shallow water region where the environment is quite complex.

A high quality shallow water release had been designed and developed under this program. Experiments had been made in the shallow water in Xiamen Harbor, South China Sea and other regions, showing that release was sensitive and reliable, and

[Continuation of XIAPEN DAXUE XUEBAO--JIRAN KEXUE BAN No 1, Feb 80 pp 46-53]

has a good ability of anti-interference. Even under the serious conditions of 10 meter-deep shallow water acoustic channel, the release distance still maintained is more than 2.5 nautical miles.

The digital correlation receiving method can also be used in underwater digital communication and digital information transmission.

* This article was written by XU Yingsheng (8079 1131 1073).

AUTHOR: ZHOU Shumin (0719 4801 3046)
ZHANG Yingshen (1728 3467 1164)
YAO Shihang (1202 1102 0193)
XU Janyun (8079 1367 0934)
CAI Jiale (9591 0902 0519)
CHEN Bingyi (7115 8426 1744)
FANG Jiafu (2455 0902 4399)
XU Shuhai (8079 2579 2818)

ORG: All of the Department of Chemistry

TITLE: "The Effect of Some Additives on Copper Electrodeposition in Acidic Solutions"

SOURCE: XIAPEN DAXUE XUEBAO--JIRAN KEXUE BAN [JOURNAL OF XIAPEN UNIVERSITY--NATURAL SCIENCES EDITION] in Chinese No 1, Feb 80 pp 54-70

TEXT OF ENGLISH ABSTRACT: The electrochemical behavior of the additives (2-thio-ethanedithione (H_2), sodium dodecylthiosulfonate (SDS), and chloride ion) usually employed in acidic copper plating, the effect of these additives on the leveling power of electrolyte, and the micro-structure and internal stress of the deposits were studied. On the basis of experimental results the mechanism is

[Continuation of KIAMEN DAILY NEWS—ZIRAN XINSHI DAILY No 1, Feb 80 pp 94-95]

discussed. The diffusion-controlled absorption of H_2 and its inhibition on copper electrodeposition, the absorption of S_2 and Cl^- ion and the corrosion of both electrodes with copper ions may result in producing a deposit with fine crystal grains and small internal stress.

AUTHOR: CAO Shoujiang [2580 1343 6975]
LIN Ruohua [2651 3043 7200]
ZENG Jialang [2382 6895 7093]
XU Peizhen [6879 3093 9090]
CHEN Dan [7115 1795 1304]

ORG: All of the Department of Chemistry

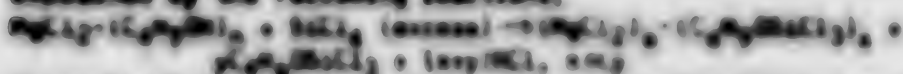
TITLE: "Mechanism of Chemical Imposition of Supported Ziegler-Natta Catalysts and Nature of Active Centers. 1. IR Spectroscopic Study"

SOURCE: KIAMEN DAILY NEWS—ZIRAN XINSHI DAILY [JOURNAL OF KIAMEN UNIVERSITY—NATURAL SCIENCES EDITION] in Chinese No 1, Feb 80 pp 71-82

TEXT OF ENGLISH ABSTRACT: Highly active supported Ziegler-Natta catalyst for olefin polymerization has been prepared by a modification of the known method. $HgCl_2$ was treated consecutively with $n-C_4H_9OH$, $SnCl_4$ and $TiCl_4$. The intermediate product in each step of the catalyst preparation has been characterized by means of IR spectra. The observed changes in characteristic IR absorption bands of $Si-O$ bond (1200 cm^{-1} , str.), $Ti-O$ bond (1070 cm^{-1} , str.; 625 cm^{-1} , bending) and $C-O$ bond (1276 cm^{-1} , and 1033 cm^{-1} str.) in the $Si-O-C$ and $Ti-O-C$ groups, as well as of $Si-Cl$ bond (680 cm^{-1} and 593 cm^{-1} , asym. str.), and $Ti-Cl$ bond (699 cm^{-1} and 470 cm^{-1} , asym. str.), show

[Continuation of KIPER DASH HSEBO--JIRAN KETHE SHR No 1, Feb 80 pp 71-82]

that there are 1,3-O-C groups in catalyst precursor (before mixing with AlR_3). Details of assignment of the above-mentioned band have been given. The changes in IR spectra of the samples from consecutive steps of catalyst preparation can be explained by the following reactions.



The active component AlCl_3 might be bound to the HgCl_2 species via an oxygen bridge, or Cl bridge. In catalyst precursor may be denoted as $(\text{HgCl}_2)_2 \cdot (\text{C}_6\text{H}_5)_2\text{O} \cdot \text{AlCl}_3$.

* GAO Hailan [1920 1920 1927] and LI Wenbo [1920 1929 1996] also participated in the study.

AUTHOR: GAO Hailan [1920 1920 1927]
 WANG Jiaohang [1920 1929 1996]
 FANG Yuesi [1920 1920 1927]
 BING Jialiang [1920 1929 1996]

ORG: GAO and WANG both of the Physicochemistry Research Group, Xiamen University;
 FANG and BING both of the Institute of Chemistry, Chinese Academy of Sciences, Beijing

TITLE: "Isolation and Structure Determination of a Physiologically Active Substance from the Leaves of *Calanthe sinensis*"

SOURCE: XIAO KIPER DASH HSEBO--JIRAN KETHE SHR [JOURNAL OF XIAO UNIVERSITY--NATURAL SCIENCES EDITION] in Chinese No 1, Feb 80 pp 83-86

TEXT OF ENGLISH ABSTRACT: A physiologically active ingredient from leaves of evening glory (*Calanthe sinensis* L.) (Rene) has been isolated and purified by means of column chromatography and recrystallization from dilute ethanol. One of the active ingredients is a colorless needle m.p. 181-183°C (decolor) (lit 180°C).

Preliminary characteristics of IR, MS, NMR spectra and functional-group tests show that the substance is an 11-O-pentacyclopentide of ethyl jalapinate, and is named 11 Calanthe A, or KC-2.

[Continuation of XIAMEN DAILY NEWS—ZIRAN KELE BAN No 1, Feb 68 pp 63-90]

The epoxide is an ethyl 11-hydroxyheptadecanoate, i.e., ethyl palmitate.
Calcington 8 is found to be a plant growth regulator.

* The following persons also took part in the present study: HONG Kaichun (7826 3269 3035), ZHANG Liangchun (6774 3177 3050), CHEN Yanning (7113 9269 1250), HU Yuchun (5170 0645 1557), ZHANG Fongsheng (1728 7364 4545) and HU Bingzong (6079 3521 7180), all of Xiamen University, and JIANG Buzhi (9392 1129 2539), CHEN Bining (7115 4790 2634) and HU Yuchan (5120 3765 3791), all of the Institute of Chemistry, Chinese Academy of Sciences.

AUTHOR: LIU Wenyuan (0091 2429 6678)
CHEN Hongping (7115 5170 6800)
LIN Xinyun (2051 6423 0061)

ORG: All of the Department of Chemistry

TITLE: "Determination of Trace Chloride in Hydrobromic Acid of Special Purity"

SOURCE: XIAMEN DAILY NEWS—ZIRAN KELE BAN [JOURNAL OF XIAMEN UNIVERSITY—NATURAL SCIENCES EDITION] in Chinese No 1, Feb 68 pp 91-98

TEXT OF ENGLISH ABSTRACT: A new method for the determination of trace chloride in hydrobromic acid of special purity is described. The sample is treated with potassium bromate and the acidity of the solution is adjusted to 0.5N with sulfur. The solution is then heated to and kept at 70-80°C until the volume of the solution is evaporated to about 6 ml in order to eliminate the bromide which interferes with the photometric determination of chloride. With the addition of 2 drops of 20 N HNO₃, the heating is continued to eliminate the bromide completely. Then the volume of the solution is adjusted to 10 ml, 0.02N HNO₃, and mixed reagent of Hg-As(Hg₂)₂. Benzene and dithionitrosobenzene solution is added. The absorbance of the extracted organic phase at 562 mμ is measured.

[Continuation of XIAMEN DAXUE XUEBAO--XIAMEN KEJUE BAN No 1, Feb 80 pp 91-98]

The recovery of the method proposed is 98%, and the precision is satisfactory. As little as 0.0001% of chlorine can be detected.

* FU Xingjie [6725 6423 6855], XU Xianlin [6151 7185 2651] and LIU Qingjun [2651 3237 6363] also participated.

AUTHOR: ZHANG Jiazhong [1778 6855 1084]
QIU Guangfeng [6726 3237 7384]
CHEN Ningjun [7115 2456 6363]

ORG: All of the Institute of Oceanography, Xiamen University

TITLE: "Model ME₁-2 Designed pH Meter"

SOURCE: XIAMEN XIAMEN DAXUE XUEBAO--XIAMEN KEJUE BAN [JOURNAL OF XIAMEN UNIVERSITY--NATURAL SCIENCES EDITION] in Chinese No 1, Feb 80 pp 99-105

TEXT OF ENGLISH ABSTRACT: This paper describes a designed pH meter with the following features: high precision, the average deviation being within 0.02pH/2pH; automatic temperature compensation; slope-compensated measurement for two-point location; range of location 0-14 pH; digital display of pH value and temperature value of aqueous solution. The working principle of the circuit is also briefly discussed.

* Also taking part in the research were: XU Xianlin [6725 2556 7229], CHEN Yuesun [7115 0957 5399], CHEN Yingjie [7115 5391 4309] and ZHANG Fan [1778 9048]; also ZHANG Yuesun [2582 0609 4767] and GU Qian [6722 6756 1984], both of the Xiamen Analytical Instrument Plant No 2.

AUTHOR: LIN Peng [2632 7720]
YE Qinghua [3509 1997 5476]

ORG: Both of the Department of Biology

TITLE: "A Tentative Calculation by Computer on the Relative Modulus of the Ecological Factors and the Peak Periods of Incubation of Yellow Rice Borer"

SOURCE: XIAMEN XIAMEN DAXUE XUEBAO--XIAMEN XUEKE BAO [JOURNAL OF XIAMEN UNIVERSITY--NATURAL SCIENCES EDITION] in Chinese No 1, Feb 80 pp 105-110

TEXT OF ENGLISH ABSTRACT: The data of the ecological factors and the peak periods of incubation of yellow rice borer (*Pyrausta nubilalis*) observed in Tongan, Fujian Province, have been calculated through the computer (V66). The results show that the main factors related to the peak periods of incubation of this insect in its first generation depend chiefly on the number of days when the average temperature per day is not less than 19°C, while the relative humidity is equal to or over 80 percent.

The two highest correlation coefficients are $R_1=0.88992$ and $R_2=0.88291$. Using two formulas, formulas 6 and 7, to forecast the peak periods of incubation in 1979, the gap between theory and practice is less than one day.

AUTHOR: YAN Zaijun [0817 1311 3182]

ORG: Physics Department

TITLE: "A Discussion on the Two Classical Statements of the Second Law of Thermodynamics"

SOURCE: XIAMEN XIAMEN DAXUE XUEBAO--XIAMEN XUEKE BAO [JOURNAL OF XIAMEN UNIVERSITY--NATURAL SCIENCES EDITION] in Chinese No 1, Feb 80 pp 111-116

TEXT OF ENGLISH ABSTRACT: In this paper, it is shown that both the Clausius and the Kelvin statements of the second law of thermodynamics are not quite perfect, and two improved statements are suggested.

AUTHOR: CHEN Tienan (7115 7535 6982)
CPU Denlan (5949 6870 1528)
LIN Huanhui (2651 5479 3055)

ORG: All of the Chemistry Department

TITLE: "Air Cathode for Industrial Electrolysis of Brine"

SOURCE: Kiang Kiang SANG KUEHO--JIRAN KIELE DAN JOURNAL OF KANGEN UNIVERSITY--
NATURAL SCIENCES EDITION In Chinese No 1, Feb 60 pp 119-120

TEXT OF ENGLISH ABSTRACT: It is shown that, by making use of the oxygen reduction
at the air cathode instead of the hydrogen evolution at the iron cathode, the cell-
voltage can be decreased (by about 1 volt) for electrolysis of NaCl aqueous solution.

9717
CSG: 4389

AUTHOR: YUAN Yeli [5913 2814 4539]

ORG: Institute of Oceanology, Chinese Academy of Sciences

TITLE: "A Preliminary Study on the Circulation Related of the Cold Water-Mass of the Yellow Sea 1. The Thermal Structure and the Characteristics of the Circulation in the Central Part of the Cold Water-Mass"

SOURCE: Beijing HAIYANG YU HUZHAO [OCEANOLOGIA ET LIMNOLOGIA SINICA] in Chinese Vol 10, No 3, Jul 1979 pp 187-199

EXCERPTS FROM ENGLISH ABSTRACT:

This paper is a preliminary study on the hydrodynamical model describing the thermal structure and the properties of circulation related to the Cold Water-mass of yellow sea.

From analysis of observations we obtain following five characteristics: 1. The variation of temperature is larger than that of salt, the variation of density is, therefore, essentially dependent on the variation of temperature. The state equation of the sea

[Continuation of HAIYANG YU HUZHAO Vol 10, No 3, Jul 1979 pp 187-199]

water may be approximately written as $\rho = \rho_0(1 - \alpha T)$. There is a thermocline layer which varies with season, and divides the Cold Water-mass into upper and lower homogeneous layers. The contour of most isotherms takes the form of a "platform". In the central part, the form of isotherms appears concave downwards a little bit and analogous to the form of the bottom, i.e. in coordinates $(r' = \alpha/ - H(r), r' = r)$, the isotherms are very flat. The region with such characteristics occupies the upper layer, the thermocline layer and the most of the lower layer, it is referred to primary temperature-structure region. 2. The motion scale. The motion of water is quite weak, the characteristic scale V of the tangential (circular) component of velocity is about 30 cm/sec, which is much larger than the radial one U , i.e. $V \sim 10 U$. 3. The space scale of motion. The horizontal scale $L \sim 100$ km, the vertical scale $|H_d| \sim 55$ m. Therefore, $L \gg |H_d|$, the vertical component of the motion equation can be simplified as the static balanced equation. 4. The time scale of motion. The time interval in which the temperature increases is taken as the time scale T_0 , $T_0 \sim 10^6$ sec. 5. Determination of the turbulent coefficient of heat conduction.

[Continuation of HAIYANG WU ZHILIAO Vol 10, No 3, Jul 1979 pp 187-199]

Thanks are due to Mr MAO Hanli [1019 3352 6609] for his counsel and GUAN Bingxian [1019 6626 6161] for discussions.

Received 20 November 1978.

AUTHOR: FANG Ceshong [2655 0948 3163]

ORG: Institute of Oceanology, Chinese Academy of Sciences

TITLE: "Dissipation of Tidal Energy in Yellow Sea"

SOURCE: Beijing HAIYANG WU ZHILIAO [OCEANOLOGIA ET LIMNOLOGIA SINICA] in Chinese Vol 10, No 3, Jul 1979 pp 200-213

TEXT OF ENGLISH ABSTRACT:

The solution of a progressive long wave under the action of non-linear friction has been derived in the present paper, and from that it is pointed out that the ratio r of amplitude of neap tide to that of spring tide will increase gradually in the direction of propagation of the waves, and the amplitude ratio $H_s : H_n$ will decrease accordingly. The effect caused by the frictional nonlinearity is one of the most important factors that make the average value of $H_s : H_n$ in the world ocean less than the theoretical ratio of the tide-generating forces.

Based on the tidal constants at the two ends of the mouth section and the variation of the ratio r from the mouth section to the closed end, the following results for Hwang Hai (the Yellow Sea) have been obtained: (1) The energy flux of principal

[Continuation of HAIYANG YU HUXIAO Vol 10, No 3, Jul 1979 pp 200-213]

lunar and solar semidiurnal incident waves passing through the mouth section is 0.80×10^9 erg/sec. (ii) When the waves get to the closed end, about 44% (for neap tide) or 77% (for spring tide) of the energy has been dissipated. (iii) The quadratic friction coefficient is 0.0022. (iv) The total energy of the principal lunar and solar semidiurnal tides in Hwang Hai amounts to ca 2.3×10^9 erg. (v) The mean amplitude of tidal current is estimated to be about 49 cm/sec, and the mean range about 2.1 m. (vi) The Q of semidiurnal tide is estimated to be 5.0 on the average.

Thanks are due the United States Theoretical and Applied Mathematics Visit-to-China Delegation and Dynamic Oceanography Faculty Research Section of Shandong Oceanography College for discussions. Professor MAO Nanli [3029 3352 4409] revised the draft.

Received 4 October 1978.

AUTHOR: ZHANG Zhengbin [1728 2973 2430]
LIU Liansheng [0491 5571 3932]
CHEN Wianyi [1745 1819 6318]

ORG: ZHANG and LIU of the Department of Oceanological Chemistry, Shandong College of Oceanology; and CHEN of Shanghai Metallurgy Institute, Chinese Academy of Sciences

TITLE: "A $\Phi(\frac{2}{1}, x)$ Rule of Chemical Processes in Oceans and Its Applications VII. The Transport of Elements in Oceans and the Screening Loss Parameter"

SOURCE: Beijing HAIYANG YU HUXIAO [OCEANOLOGIA ET LIMNOLOGIA SINICA] in Chinese Vol 10, No 3, Jul 1979 pp 214-229

EXCERPTS FROM ENGLISH ABSTRACT:

This article expands the $\Phi(\frac{2}{1}, x)$ rule in significance of the parameter of screening loss R_s and discusses its application in the study of the transport processes of elements in oceans.

Received 21 June 1978.

AUTHOR: CHEN Zongyong [7115 1350 6970]

ORG: Shandong College of Oceanology

TITLE: "A Model for Tidal Harmonic Analysis and Prediction"

SOURCE: Beijing HAIYANG YU BIZHAO [OCEANOLOGIA ET LIMNOLOGIA SINICA] in Chinese Vol 10, No 3, Jul 1979 pp 230-237

EXCERPTS FROM ENGLISH ABSTRACT:

This article is based upon the new computations of the tide-generating potential by D. E. Cartwright (1971, 1973), and applies the Rayleigh criteria to the main constituent frequencies to determine whether or not they are to be included in the analysis. We take 117 terms, their Cartwright's coefficients being more than 0.001 out of the harmonic 2nd-degree terms. Among these terms only 67 terms can be separated.

The conclusion is that to determine the harmonic constants H and g for a place from one year's observations the correction through f and v yields better results. Tidal analysis and prediction by means of the correction here proposed are more refined and effective than that by the calculation of f and v .

[Continuation of HAIYANG YU BIZHAO Vol 10, No 3, Jul 1979 pp 230-237]

Thanks are due Professor HE Chongben [6370 1504 2409] for revising the draft, as well as FANG Guohong [2455 (1948 316)], WANG Ji [3760 7535], CHEN Ansheng [2052 1366 3932], VING Renfang [2019 (1970 2455)] and colleague YU Zhousen [0151 1352 2429] for providing counsel.

Received 28 October 1978.

AUTHOR: GU Changshou [0102 6389 0337]
GUO Baichang [7509 7181 9932]
CHEN Baichang [7115 1795 2052]
ZHOU Baichang [0719 4102 2052]
CAI Peixian [5591 1016 6362]
SHEN Shuai [5516 2579 0823]
WEN Zongren [3306 1350 1317]
CHEN Gang [0676 0488 5030]

ORG: GU, ZHOU, SHEN, WEN and CHEN of Institute of Oceanology, Chinese Academy of Sciences, GUO and CAI of Lianjiang Aquatic Culture Station, Fujian Province; and CHEN of Institute of Marine Fisheries, Fujian Province

TITLE: On the Malformation Disease of *Lutjanus Sporelinga*

SOURCE: Beijing HAIYANG YU WUJIAO [OCEANOLOGIA ET LIMNOLOGIA SINICA] in Chinese Vol 10, No 2, Jul 1979 pp 238-251

EXCERPTS FROM ENGLISH ABSTRACT:

Since the late 1950s, under the guidance of Prof. C. E. Tseng, we have succeeded in deriving a method of rearing young sporplings at low temperature by collecting

[Continuation of HAIYANG YU WUJIAO Vol 10, No 2, Jul 1979 pp 238-251]

The spore is very common instead of scarcity or late autumn. The spore and embryo, only the gametophyte and the young sporophyte are collected in spawning culture station, somewhat like a greenhouse, in a temperature of about 8-10°C. By means of changing the time of spore collection, the sporophyte, when taken out from the cultivation system and cultured in the open sea in middle or late autumn, are already 1-2 centimeters in size and are able to grow faster, resulting in a larger frond and a higher production. Unfortunately, it happened that sometimes the sporplings died due to a destructive disease of unknown nature. In serious cases, all the sporplings died within a few days.

CHEN Biao [7115 9823], LIANG Yuesun [2733 0988 0356] and GUO Pinghui [1327 1827 0418] took part in the work. Professor SHEN Changhui [2582 0701 1145] revised the draft. FENG Shouliang [1627 0412 5328], FENG Minghua [1638 2666 5478], SHEN Baichang [1365 5479 0022], ZHOU Baichang [0719 7339 0894] and ZHANG Jingui [1728 0079 3184] provided assistance.

Received 16 February 1979.

ORD: 6489

AUTHOR: WANG Zhongqi [3769 2399 0037]
 WU Manchun [1079 2429 1937]

ORG: East of Shandong University

TITLE: "KNO Scaling and Scaling in the Mean"

SOURCE: Beijing GAKENG WULI YU XUEBAI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese No 5, Sep 79 pp 323-329

TEXT OF ENGLISH ABSTRACT: In this paper Fokya distribution has been derived from Bose statistics, then using that, KNO scaling in multiparticle production of high energies is explained. Then it is assumed that the clusters are produced via multi-peripheral exchange of Regge trajectory and the cluster number obeys one-dimensional Boltzmann distribution. Finally, the properties of cluster's moment are analyzed and scaling in the mean in semi-inclusive process is deduced.

AUTHOR: XIE Qiang [0230 0037 0216]

ORG: Shandong University

TITLE: "Stochastic Mechanism for Hadronic Multiple Production and Average Charged Multiplicity"

SOURCE: Beijing GAKENG WULI YU XUEBAI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese No 5, Sep 79 pp 330-340

TEXT OF ENGLISH ABSTRACT: By assuming that in a high energy hadronic collision process, n pairs of struts are produced together with pions, the number of which is assumed to be proportional to the number of "links" between any two struts, we are able to get a relation between the Q -value and the number of pairs n : $n^2 \sim (Q/Q_0)^2 - Q_0$.

The average charged multiplicity $(N_{ch})_{\text{exp}}$ is calculated, and is compared with the experiments. The data of $pp, n\bar{p}$, pp collisions all coincide with the theoretical curve in a wide range of energies. The deviation between the energy vs. charged multiplicity relations for neutron-proton and proton-proton collision processes are explained quantitatively. The average struts also estimated from the theory is in good agreement with that given by other authors.

AUTHOR: YANG Chuliang [2799 2006 5320]

ORG: Shandong University

TITLE: "A Method for Finding Potentials Corresponding to Polynomial-Factor Eigenfunctions in Quantum Mechanics"

SOURCE: Beijing SACHENG WULI TU XUEBAO [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARE] in Chinese No 5, Sep 79 pp 541-554

TEXT OF ENGLISH ABSTRACT: A method for finding potentials corresponding to polynomial-factor eigenfunctions is given for the Schrodinger equation as an example. It is shown that the eigen-solutions for harmonic and Coulomb's potentials in quantum mechanics are the two examples which can be given by this method and some other examples are discussed. This method and some results of this paper may be useful for hadron structure model theory. One of the examples is the equation in a reference which is derived from the Bateman-Solpeter equation for the case that the electron is tightly bound in certain potential well. When this method is applied to that equation for three-dimensional central symmetric potential $V(r) = V_0 - \frac{1}{2}V_1 r^2 + \frac{1}{4}V_2 r^4 - \frac{1}{6}V_3 r^6 + \dots$, some results are obtained in which λ' must be considered as a linear function of r^2 . The so-called "quantum Ruge trajectory" behavior is manifested.

AUTHOR: WANG Pei [3740 3006]
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ORG: WU of Sichuan University; WU of Northwest University

TITLE: "The Multiplet-Spherical Solutions of the SU(N) Gauge Theory"

SOURCE: Beijing SACHENG WULI TU XUEBAO [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARE] in Chinese No 5, Sep 79 pp 505-571

TEXT OF ENGLISH ABSTRACT: We study the multiplet solutions of the SU(N) group gauge systematically, generalize the current spherically-symmetrical multiplet to the multiplet-spherical symmetrical case, and give the complete classification of the multiplet solutions. As examples, we have calculated the SU(3) and SU(4) multiplets in detail, and discuss some problems, such as angular moments and topological quantum numbers.

AUTHOR: WANG Mingsheng [3769 2490 (J22)]
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TITLE: "The Electromagnetic Form Factor of the ρ^0 Meson in the Sato Model"

SOURCE: Daizang GAKEN WA.I YU HEN.I [PHYSICA ENERGIAE FONTIS ET PHYSICA NUCLEARIS] in Chinese No 5, Sep 79 pp 572-581

TEXT OF ENGLISH ABSTRACT: In the Sato model, the wave functions of the ρ^0 meson can be obtained numerically from the Bethe-Salpeter equation. The problem of comparing experiment with the mesonic electromagnetic form factor calculated by analytical continuation of the wave functions from the Euclidean space back to the Minkowski space is an unsolved problem. On the basis of analyzing the analytic property of the form factor, we proved that by choosing a special reference system in which the photon is space-like, one may calculate the physical space-like

[Continuation of GAKEN WA.I YU HEN.I No 5, Sep 79 pp 572-581]

electromagnetic form factor directly from the Euclidean D-S wave functions of the meson in the Euclidean space. As an example, we calculated the electromagnetic form factor of the pseudoscalar meson by using the wave functions corresponding to various choices of parameters. Preliminary results show that the theoretical calculation may be in accordance with the experiment by appropriately choosing the parameters.

AUTHOR: YAN HUIJIAN [7051 2092 7207]
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ORG: All of the University of Science and Technology of China

TITLE: "Canonical Quantization of Gauge Fields (III)—Gravitational Field"

SOURCE: Beijing GABENS WA.I YU HENGLI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese No 5, Sep 79 pp 582-594

TEXT OF ENGLISH ABSTRACT: The gravitational field is quantized within the canonical formalism under the harmonic gauge condition. The gravitational field is decomposed into transverse fields and self-connecting fields. The equation of motion of the self-connecting field $\bar{h}_{\mu\nu}$ is derived, and the contributions of self-connecting fields to physical S-matrix elements are investigated. Thus the gauge compensating term of the effective action is obtained. The result is in agreement with that obtained by the path integral method, but with our method the difficulty of the earlier gauge ambiguity can be overcome.

AUTHOR: LI Tingsuo [3021 2254 0900]
JIANGLI Shuangqin [1252 3562 2031]

ORG: Both of the Institute of High Energy Physics, Chinese Academy of Sciences

TITLE: "Theory of (π^0, π) Reaction"

SOURCE: Beijing GABENS WA.I YU HENGLI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese No 5, Sep 79 pp 595-603

TEXT OF ENGLISH ABSTRACT: In this paper the Bethe-Heitler action formula for the (π^0, π) reaction is derived in the model of one-meson description of pion, and the differential cross sections for $\pi^0(\pi^0, \pi)$ and $\pi^0(\pi^0, \pi)$ reactions are estimated in PMS. This kind of reaction is regarded as a π^0 resonance for the studies of absorption processes and the nuclear pion structure.

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TITLE: "Measurement of Delay Time Distribution of Beta-Ray Proportional Counter"

SOURCE: Beijing GASEOUS WALL TO GEMMA-1 (PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS) in Chinese No 5, Sep 79 pp 604-609

TEXT OF ENGLISH ABSTRACT: Delay time distribution of RPE has been measured systematically, and experimental results have been roughly analyzed.

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ORG: All of the Institute of Atomic Energy, Chinese Academy of Sciences

TITLE: "Microscopic Study for Spontaneous Fission of ^{238}Pu "

SOURCE: Beijing GASEOUS WALL TO GEMMA-1 (PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS) in Chinese No 5, Sep 79 pp 610-615

TEXT OF ENGLISH ABSTRACT: On the basis of the cluster shell model of double well, a new method for calculating the kinetic energy of the relative motion of the fission fragments has been proposed, and in this way the potential energy curve for spontaneous fission of ^{238}Pu has been calculated. In the calculation, the effects of the Coulomb potential and the spin-orbit effect of the motion of the center of mass have been considered properly. The results can qualitatively explain the observable property of ^{238}Pu . It seems that the method proposed in this paper might serve as a way to describe the fission process in microscopic study.

AUTHOR: YANG Fushuo [J799 4395 1367]
TANG Chaoping [J882 1367 6979]

ORG: Dept of Fudan University

TITLE: "The Decay Law of Complex Conjugate Processes"

SOURCE: Beijing GAKHENG WULI YU HEBUOLI [PHYSICA CHIMICA FUJIS ET PHYSICA NUCLEARIS] in Chinese No 5, Sep 79 pp 616-623

TEXT OF ENGLISH ABSTRACT: The decay law of complex processes involving many levels is presented. It can be used to correct all the data obtained by considering only one level in the determination of the mean lifetime of high spin states with the in-beam pulse method or the recoil distance method.

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TITLE: "The Study of Two Non-Isolated Resonances for the $^{23}\text{Ne} (p, \alpha)^{20}\text{Ne}$ Reaction"

SOURCE: Beijing GAKHENG WULI YU HEBUOLI [PHYSICA CHIMICA FUJIS ET PHYSICA NUCLEARIS] in Chinese No 5, Sep 79 pp 624-630

TEXT OF ENGLISH ABSTRACT: The excitation functions of the $^{23}\text{Ne} (p, \alpha)^{20}\text{Ne}$ and the $^{23}\text{Ne} (p, \alpha)^{20}\text{Ne}_{1st}$ reaction have been measured from E_{lab} to 1.5 MeV at $\theta = 30^\circ, 150^\circ$ and 180° respectively. Around the resonance at 1.171 MeV, the excitation functions of the (p, α) reaction have been measured at 12 angles. Some other angular distributions have been obtained from their excitation functions. In addition, the angular distribution of the (p, α) reaction for the resonance at 1.171 MeV has also been measured directly at energy of the resonance peak of the

[Continuation of GADENS VOL.1 TO NERL.1 No 5, Sep 79 pp 626-630]

excitation function at 180° . For the resonance at 2.117 MeV, the angular distribution has been measured at two energies, one at the energy of the resonance peak of the excitation function at 180° , another at the energy of the half maximum point of the resonance peak on the higher energy side. Around the resonance at 2.875 MeV, the excitation functions have been measured at 16 angles, and the angular distribution has been obtained from these excitation functions. The angular distributions of the three resonances are not symmetric at about 90° , and the positions of the resonance peaks of these resonances vary with the angle of measurement. By means of the compound nucleus theory, discussions have been made for these non-isolated resonances.

AUTHOR: ZHANG RALPH [A720 6932 3794]

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TITLE: "Spin-Saturn Resonance and Core Polarization Effects"

SOURCE: SHANGHAI GADENS VOL.1 TO NERL.1 [PHYSICA TIBETANA PARTIS ET PHYSICA NUCLEARIS] in Chinese No 5, Sep 79 pp 626-630

TEXT OF ENGLISH ABSTRACT: The effects of the coupling term between field $(V_0 \phi_1)_{10}$ and $r^{10}(V_2 \phi_1)_{10}$ coming from tensor operator are discussed for the spin-saturn double resonance. The effects of including the field $r^{10}(V_2 \phi_1)_{10}$ on the spin-saturn multiple resonance and core polarization are considered.

AUTHOR: WANG Rong (2076 1309)

OR: Institute of High Energy Physics, Chinese Academy of Sciences

TITLE: "A Proof of Two Identities Concerning the Interchange in the Order of Integrations"

SOURCE: Beijing GAKHIN VOL.1 NO.1 [PHYSICA CHINESE PARTIS ET PHYSICA SINGAPURIS] in Chinese No 5, Sep 79 pp 643-648

TEXT OF ENGLISH ABSTRACT: Assuming measurability and weak operator convergence, a simple proof of two identities in the composite field theory concerning the interchange in the order of integrations is given.

AUTHOR: TAN Lanchang (2223 0243 2406)

OR: He Lian from the Institute of High Energy Physics, Chinese Academy of Sciences

TITLE: "The Characterization of a G-M Counter under an Additional HV Voltage"

SOURCE: Beijing GAKHIN VOL.1 NO.1 [PHYSICA CHINESE PARTIS ET PHYSICA SINGAPURIS] in Chinese No 6, Nov 79 pp 684-687

TEXT OF ENGLISH ABSTRACT: A preliminary experimental study of a G-M counter under an additional HV voltage and a theoretical analysis of the design threshold voltage under this condition are presented.

AUTHOR: ZHANG Gangyong [A729 1987 3632]

ORG: Hunan University

TITLE: "The Formulae of Matrix Elements of the Two-Body Spin-Orbit Interaction"

SOURCE: BoJiang GAKHIN WU.I TU HENGLI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] In Chinese No 6, Nov 79 pp 630-636

TEXT OF ENGLISH ABSTRACT: In this paper, we derived the general formulae for the matrix elements of the two-body spin-orbit interaction between two particles in the shell model. The formulae which we derived are simpler than those of J. Naps and L. H. Lomgren.

AUTHOR: HE Zumein [B149 4373 1652]
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HONG of the Institute of High Energy Physics, Chinese Academy of Sciences

TITLE: "On the Applications of Strong FLM"

SOURCE: BoJiang GAKHIN WU.I TU HENGLI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] In Chinese No 6, Nov 79 pp 666-673

TEXT OF ENGLISH ABSTRACT: In this article we study the field-current relations of the δ -divergence of the axial vector currents. If there exists a series of radial excited states, then δ -divergence of the axial vector current will be identical with the fields of all existing pseudo-scalar mesons. From this relation we can derive a definite correction to the matrix elements obtained by FLM and low energy theorems in the current algebra calculations. Concrete calculations show all results obtained by these corrections agree with the experiments.

AUTHOR: YU Youren [2151 0645 2479]

ORG: Institute of High Energy Physics, Chinese Academy of Sciences

TITLE: "The Interaction of Antinucleon with Nucleus"

SOURCE: Beijing GAKENG WU: YU HENG: [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese No 6, Nov 79 pp 676-680

TEXT OF ENGLISH ABSTRACT: The possible existence of the narrow width structures in the Antinucleon-Nucleus system is discussed qualitatively by using the complex shell model theory. We conclude that the repulsive coherent energy levels exist for one Antinucleon-one nucleus hole system, its energy is quite high and some times higher than the threshold of the system. Its width is narrower than that of the same order configuration. Experimentally it is possible to find out a number of narrow resonances and bound states.

AUTHOR: WU Dazhi [0702 0030 6611]

ORG: Institute of High Energy Physics, Chinese Academy of Sciences

TITLE: "The Relation Between Cabibbo-like Parameters and Quark Masses in the E-8 Model"

SOURCE: Beijing C. JENG WU: YU HENG: [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese No 6, Nov 79 pp 681-687

TEXT OF ENGLISH ABSTRACT: In the E-8 model with two Higgs doublets we introduce permutation symmetry S_2 and naturally obtain the Cabibbo-like parameter matrix represented approximately by the ratios of the quark masses. The symmetry of S_2 representation assignments between right- and left-handed quarks is a characteristic of this model.

AUTHOR: HE Ju (0149 3515)
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ORG: HE Ju and ZHANG both of the Institute of High Energy Physics, Chinese Academy of Sciences; HE Zumin of the Institute of Theoretical Physics, Chinese Academy of Sciences

TITLE: "The Approximate B-S Wave Function for Electromagnetic Bound States Consisting of a Fermion and an Anti-Fermion of Spin $1/2$ "

SOURCE: Beijing GABENS GAI TU HENGLI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese No 6, Nov 79 pp 688-696

TEXT OF ENGLISH ABSTRACT: The Bethe-Salpeter equation for the electromagnetic bound states consisting of a fermion and an anti-fermion of spin $1/2$ is solved in the ladder approximation in this paper. The well-known Salpeter series is obtained together with the B-S wave functions, which are relativistic covariant, also have correct analytic properties and satisfy the spectra conditions. The results are applied to the processes $\pi^0 \rightarrow \gamma + (e^+e^-)$ and $\pi^0 \rightarrow \gamma + (\mu^+\mu^-)$. It is shown that the creation, annihilation and transition processes of such relativistic electromagnetic bound states can be calculated conveniently by using the approximate B-S wave functions obtained in this paper.

AUTHOR: HOU Boyu (0186 0130 1342)
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ORG: HOU Boyu of Northeast University; HOU Boyun of Inner Mongolian University

TITLE: "Zero Energy Fermion in Topological Nontrivial Spherical Symmetrical Field on Riemann Space"

SOURCE: Beijing GABENS GAI TU HENGLI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese No 6, Nov 79 pp 697-707

TEXT OF ENGLISH ABSTRACT: This paper discusses the number of solutions and physical properties of zero energy fermions in the field of U(1) pointlike monopole. It is interesting to point out that the anomaly source of F&E lies on the monopole, and that the effective electric charge is concentrated at the point monopole.

This paper has separated explicitly the variables in the equation of the half spin particles with arbitrary isospin moving in the spherical symmetric sourceless SU(2) gauge field. It is shown that the zero energy solution exists only when the total angular momentum $J=0$ and charge number $|v|=\frac{1}{2}$; or when $J=\frac{1}{2}$, $|v|=1,0$. The solutions with isospin equal to one or arbitrary half integrals are given explicitly.

AUTHOR: ZHANG Linyang [6792 1669 1684]
LIU Bo [0491 3134]
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TITLE: "The Isobar Configuration in Nuclei and Its Influence on the Reaction (p, π^+) "

SOURCE: Beijing GABING WU, YU HENGLI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in CHINESE No 6, Nov 79 pp 708-715

TEXT OF ENGLISH ABSTRACT: Instead of the usual model in which the incident proton becomes a neutron and a pion, we use a new model in which the incident proton becomes a Δ^0 and a pion to calculate the angular distributions of the reaction $^{26}\text{Mg}(p, \pi^+)^{27}\text{Mg}$. The results obtained show that there are considerable differences both in magnitude and patterns of the angular distributions for the two models.

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TITLE: "Nonlinear Superfields and Quark Confinement"

SOURCE: Beijing GABING WU, YU HENGLI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in CHINESE No 6, Nov 79 pp 716-722

TEXT OF ENGLISH ABSTRACT: A supersymmetric form of the two-dimensional nonlinear model is described. We discover that exact stationary solutions of the coupled equations of motion can be used as the starting point of the bag model. As a special case, we obtain again "BAG bag" model. The supersymmetric Sine-Gordon model, hyperbolic sine model, and exponential model are discussed.

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 SHEN Qixing [3080 7871 5281]
 YU Hong [6735 1347]
 ZHANG Haiman [1720 5019 2501]

ORG: All of the Institute of High Energy Physics, Chinese Academy of Sciences

TITLE: "The Deep Inelastic Scattering Processes of the Polarized Electrons on Polarized Protons"

SOURCE: [Beijing GARDENS WU1 YU HEN1] [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEONIS] In Chinese No 6, Nov 79 pp 723-733

TEXT OF ENGLISH ABSTRACT: In this paper, we have obtained the distribution functions of the valence quarks by using light-cone algebra, and the nucleon's wave functions and computational techniques in the struck model. The symmetries of the distribution functions of the valence quarks are defined by using νF_2 experimental data. We computed νF_1 and νF_2 and obtained the distribution functions of the valence quarks which possess definite helicity. The spin wave function of the nucleon's wave functions are taken as the harmonic-like type. There are two kinds of spin structure, one of them possesses the SU(6) symmetry and the other does not. The theoretical results of $A_1 \cdot \nu F_2$ are consistent with experimental data, but only in the case of SU(6) symmetry for which we obtained the sum rule

[Continuation of GARDENS WU1 YU HEN1 No 6, Nov 79 pp 723-733]

$$6 \int_0^1 \{ \nu F_1^p - \nu F_1^n \} dx = -1.16.$$

The experimental data agrees with the nucleon's wave functions with SU(6) symmetry.

AUTHOR: LIAO JIAN [1679 4949 1807]

ORG: Sichuan University

TITLE: "Shell Model Calculations on $17_{1/2}$ Nuclei"

SOURCE: Beijing GADGERS VOL. 10 NO. 1 [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese No. 6, Nov 79 pp 724-728

TEXT OF ENGLISH ABSTRACT: In this paper the pure configuration shell model with the two-body effective residual interactions deduced from the experimental data is used in the calculations of the spectroscopy properties of the nuclei in the region $40 < A < 56$. The results are compared with experimental data. We believe that for very nuclei with mass numbers ranging from 40 to 56 the simple $(1f_{7/2})^n$ model is a good approach, especially in the explanation of the higher spin states. However, there are some contradictions exposing the limitation of this model.

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ORG: All of the Institute of Atomic Energy, Chinese Academy of Sciences

TITLE: "An On-Line Four-Parameter Analysis System for Particle-Particle Correlation Experiment"

SOURCE: Beijing GADGERS VOL. 10 NO. 1 [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese No. 6, Nov 79 pp 769-778

TEXT OF ENGLISH ABSTRACT: An on-line four-parameter data acquisition and processing method for particle-particle correlation experiment is proposed. Using this method an analysis system has been set up. The detection devices, electronics and a program for a microcomputer are described. Finally the application of this system to several experiments of three body reaction is illustrated.

AUTHOR: LI Langqian [1914 0807 7197]
HU Shunshun [1910 0908 1076]
LIN Jangye [1911 1006 2014]

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TITLE: "Calculation of Interaction Times and Analysis of Transport Coefficients in Heavy-Ion Induced Deep Inelastic Collisions"

NOTE: Beijing GARDEN VOL.1 TO GARDEN.1 (PHYSICA CHINESE PARTIS ET PHYSICA CHINESE) in Chinese No. 6, Nov 79 pp 769-780

TEXT OF ENGLISH ABSTRACT: The interaction times of various partial waves for heavy-ion induced deep inelastic collisions (DIC) of six reaction systems are calculated on the basis of classical dynamics method. The resulting times are related to the energy and angular momentum dissipation. The order of magnitude of the interaction times for DIC is about $10^{-22} - 4 \times 10^{-21}$ sec. The Fokker-Planck equation may be correlated with the classical dynamic equation through the interaction times. The interaction times of various partial waves are applied to determine the same (or almost) transport coefficients of various partial waves from experimental same (or almost) distributions. The correlation between same transport coefficients and excitation energies and angular momentum dissipation are discussed. The evolution of the tangential and radial frictions are analyzed.

AUTHOR: HU Shunshun [1910 0908 1076]

ORG: Institute of Modern Physics, Chinese Academy of Sciences

TITLE: "A Phenomenological Surface Friction Mechanism in Heavy Ion Reactions"

NOTE: Beijing GARDEN VOL.1 TO GARDEN.1 (PHYSICA CHINESE PARTIS ET PHYSICA CHINESE) in Chinese No. 6, Nov 79 pp 769-771

TEXT OF ENGLISH ABSTRACT: In this paper, a phenomenological model has been proposed to explain the friction mechanism due to particle-hole excitation and neutron exchange at the initial stage of heavy ion collisions.

AUTHOR: HU JIAN (1170 3044 3046)
WANG ZHONGYANG (3789 2973 2987)

ORG: Inst of Beijing University

TITLE: "The Evaporation Model Theory for the Fission Prompt Neutron Spectrum of Heavy Nuclei"

SOURCE: Beijing GABRIEL VOL 1 TO KIBLAJ [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARE] in Chinese No 6, Nov 79 pp 772-783

TEXT OF ENGLISH ABSTRACT: The fission prompt neutron spectrum, the average number of neutrons emitted per fission and the average energies of neutrons for neutron-induced fission of uranium and plutonium isotopes were calculated using the evaporation model with a universal pre-neutron neutron component of about 145 eV obtained empirically. General approximation formulas for the average number of neutrons per fission and the average neutron energy were derived and Fermi's formula was rederived theoretically without adjustable constants. In the incident neutron energy range 0-10 MeV considered, the agreement between calculated and experimental results is satisfactory.

NUCLEI FISSION: U, Pu (n, f); energy range 0-10 MeV; fission prompt neutron spectrum, average number of emitted neutrons and neutron average energy calculated.

AUTHOR: YU HONG (6715 1307)
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ORG: All of the Institute of High Energy Physics, Chinese Academy of Sciences

TITLE: "Radiative Decay of Σ_c and Radiative Production of the New Particles"

SOURCE: Beijing GABRIEL VOL 1 TO KIBLAJ [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARE] in Chinese No 6, Nov 79 pp 784-787

TEXT OF ENGLISH ABSTRACT: In this paper we point out that the radiative production of $\Lambda/\bar{\Lambda}$ particle should contain the radiative decay of Σ_c which is produced in hadron collisions. Our results show that:

- (1) The difference between the effective coupling constant of $\Lambda/\bar{\Lambda}$ and structure and the effective coupling constant of Ψ^0 and structure is remarkably decreased.
- (2) The main results in previous work are preserved.
- (3) The fractions of $\Lambda/\bar{\Lambda}$'s produced via the photonic decay of the Σ_c states are obtained at different \sqrt{s} in the first process. Finally, we simply compare this model with the production via gluon.

AUTHOR: DENG Fanglei [2679 2635 2156]
DU Gangsheng [2679 2639 2930]

UNIT: Both of the Institute of High Energy Physics, Chinese Academy of Sciences

TITLE: " $SU_3 \otimes SU_3$ " Model and Υ -like Particles

SOURCE: Huajiang GAKENGO WA:1 TO HENRI:1 (PHYSICA ENERGIAE FORTES ET PHYSICA NUCLEARIS) In Chinese No 6, Nov 79 pp 700-710

TEXT OF ENGLISH ABSTRACT: Based on $SU_3 \otimes SU_3$ model, we discuss the assignment of Υ -family in the 8 representation of SU_3 color space.

9717
CSG: 4009

Phytophysiology

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TITLE: "Structure and Function of Chloroplast Membrane (I) Ultrastructure
and Constituents of Chloroplast Membrane in Relation to Function of Photosystem
II"

SOURCE: Shanghai ZHIMU SINGLI YUWAO [ACTA PHYTOPHYSIOLOGICA SINICA] in Chinese
Vol 5, No 2, May 1979 pp 99-107

EXCERPTS FROM ENGLISH ABSTRACT: By exposing etiolated wheat seedlings to inter-
mittent light (cycle of 2 min light 118 min dark) for 26 hr., we could obtain

[Continuation of ZHIMU SINGLI YUWAO Vol 5, No 2, May 1979 pp 99-107]

chloroplasts in their initial stages of development. These were called incom-
pletely developed chloroplast membranes. They were compared with the completely
developed chloroplast membranes. Thylakoid membranes were unstacked in incom-
pletely developed chloroplast. Whereas in completely developed chloroplasts a
large number of well stacked grana membranes were formed. Chlorophyll content
was much higher and the chlorophyll a/b ratio was lower in completely developed
ones. The incompletely developed chloroplast membranes had no complex II
(light-harvesting chlorophyll a/b protein complex) and high potential Cyt b-559
at all, but they possessed Cyt. b, Cyt. f, and low-potential Cyt. b-559.

WANG Beiru (3769 0088 0320), THANG Guosheng (1728 0062 6927), WU Gexin (7456
2710 5347) and LI Shiyi (2621 0013 0308) took part in the work. Thanks are
due Professors THAO Faiseng (3282 0080 2646), WU Zhunan (7734 6766 1344) and
ZHANG Ruchuan (3008 4938 1537) for providing counsel.

Received 16 August 1978.

AUTHOR: LIO Zhensheng [0491 2182 5116]

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TITLE: "A Study on the Accumulation and Distribution of ^{14}C -Labelled 4-Iodo-Phenylacetic acid in Organs of Rice by Microautoradiography

SOURCE: Shanghai SHEN SENLI YUZHANG [ACTA PHYTOLOGICA SINICA] in Chinese Vol 5, No 2, May 1979 pp 117-122

TEXT OF ENGLISH ABSTRACT:

The ^{14}C -labelled 4-iodo-phenylacetic acid was sprayed on the blade of the flag leaf in the ear primordia stage and flowering stage. The results obtained with microautoradiography were as follows: radioactivity was found in vascular bundle of the culm 6 hours after treatment. Later, it was chiefly concentrated in the reproductive tissue of main panicle and leaf sheath (epithelium and young panicle). Radioactivity was also occasionally found in the flowering organ 6 hours after treatment. After 3 days, the translocation of the radioactivity was

[Continuation of SHEN SENLI YUZHANG Vol 5, No 2, May 1979 pp 117-122]

mainly move to the pollen, culm flower, pollen sac and ovary wall; but not yet found in the reproductive cells such as pollen grain and ovule.

This investigation provides some theoretical basis for the elucidation of mechanism of action of ^{14}C -iodo-phenylacetic acid on the cellular level.

Thanks are due PU Jiarui [0265 1347 3843], QIU Qunzhi [0209 3123 6099], CHEN Shizhuo [7115 2249 9476], LIN Yuesi [2610 2588 1242] and LIO Yuesi [0491 0337] for providing counsel.

Received 28 September 1978.

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TITLE: "The Relationship Between the Activity of Nitrate Reductase and Nitrogenous Nutrition"

SOURCE: Shanghai SHENG SHENG SHENG [ACTA PHYTOLOGICA SINICA] in Chinese Vol 5, No 2, May 1979 pp 123-130

TEXT OF ENGLISH ABSTRACT:

Winter wheat plants (*Triticum aestivum* L. cv. Jinghe 169) were fertilized with ammonium salt at three different levels and at two growth stages when leaf sheaths were strongly curled and when the curled ends of stems were found separately. Before and after the treatment, the activities of nitrate reductase were measured both on endogenous substrates and on added (exogenous) substrates. Measurements were carried out throughout the growing period.

[Continuation of SHENG SHENG SHENG Vol 5, No 2, May 1979 pp 123-130]

A positive correlation between nitrogenous nutrition and the enzyme activity or the yield of grains was observed. With exogenous substrates, the nitrate reductase activity was three or four times that with endogenous substrates, and the maximum of the enzyme activity appeared earlier. On heavy application nitrogenous fertilizer, the nitrate reductase activity did not increase proportionally, and the yield of grains declined markedly.

Received 10 October 1978.

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TITLE: "Ways of Improving the Methods of Rice Anther Culture"

SOURCE: Shanghai SHENG GENGLI HUBAO [ACTA PHYTOPTHYCOLOGICA SINICA] in Chinese
Vol 5, No 2, May 1979 pp 131-140

TEXT OF ENGLISH ABSTRACT:

In studying culture of rice anthers on liquid medium, the following effects of several factors on induction of pollen plastids were observed:

1. Callistamine added to medium (20-50mg/l) in an early stage of culture may give rise to pollen with a large nucleus, increase the induction frequency of pollen plastids by 80% and increase the diploid proportion among pollen plants from 80% to 70%.

2. The combined use of NAA with kinetin, within the range of 0.5-0.5 mg/l, may regulate the induction of calyp and its differentiation, there are superior to

[Continuation of SHENG GENGLI HUBAO Vol 5, No 2, May 1979 pp 131-140]

0.5-D or the combination of 0.5-D with kinetin. The stage during which the endocellular plastids grow up of the pollen walls is critical for the regulation of the formation of calyp and its potential of differentiation by exogenous hormones.

3. Lower concentrations of sucrose (2-5%) are usually beneficial to the induction of pollen calyp but decrease its potential of differentiation. However, this figure depends on the kind of hormones in medium. The concentration of sucrose may regulate the intensity of effects of other factors on pollen development and possibly influence the rate of dehiscence and germination of anthers.

Ways of improving the yields in rice anther culture were suggested:

(1) to use liquid medium instead of agar medium in anther culture, (2) in an early stage of culture, to increase the pollen with symmetrical nucleus obtained by cold treatment of anthers and addition of callistamine and 5-fld to medium, (3) to isolate the multicellular pollen from the dehiscence anthers just before their growing out of pollen walls and to culture the pollen into cells separately.

Received 12 October 1978.

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TITLE: "Physiological Control of Nitrogen-Fixing Activity in Photosynthetic Bacterium *Rhodospirillum Rubrum* Capesulata"

SOURCE: Shanghai ZHONG GUO SHIJI SHUBAO [ACTA PHYTOPHYSIOLOGICA SINICA] in Chinese Vol 5, No 2, May 1979 pp 141-150

EXTRACTS FROM ENGLISH ABSTRACT:

The light-dependent nitrogen-fixation activity of the photosynthetic bacterium *Rhodospirillum rubrum* was inactivated immediately by ammonia. The duration of inactivation depended on the initial concentration of ammonia added to the media. During the inactivation period ammonia was taken up by the cells and

[Continuation of ZHONG GUO SHIJI SHUBAO Vol 5, No 2, May 1979 pp 141-150]

consumption of nitrogen-fixation activity was observed after disappearance of ammonia from the medium. Under weak light condition a markedly enhanced ammonia-inhibition was observed. Glutamine and asparagine had the same inhibitory effect on the nitrogen-fixation activity. The pattern of inactivation and reactivation kinetics were similar to those obtained with ammonia.

Received 21 November 1978.

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TITLE: "Postharvest Physiological Changes of Apple and Effect of Postharvest Treatment on Its Storage Quality"

SOURCE: Shanghai ZHIMU SHEILI XUEBAO [ACTA PHYTOPHYSIOLOGICA SINICA] in Chinese Vol 5, No 2, May 1979 pp 151-160

TEXT OF ENGLISH ABSTRACT:

The respiration rate, ethylene production and firmness of the apple fruits (Var. Red Delicious, Starking Delicious, Red Davis, White Winter Paranna, Golden Delicious) were measured after harvest and during storage. It was found that after harvest the fruit ripened quickly, climacteric rise of respiration occurred,

[Continuation of ZHIMU SHEILI XUEBAO Vol 5, No 2, May 1979 pp 151-160]

Firmness and quality decreased, and above all, production of ethylene markedly increased. Treatment which depressed and or delayed the production of ethylene in fruit had a favorable effect on the keeping quality, it appeared that the production of ethylene in fruit was an indicator of ripeness. The results of experiments of various harvesting date and various time intervals before storage showed that to store the fruit as soon as it was harvested was of great importance for prolonging storage period and improving fruit quality. Postharvest treatments with CO_2 , H_2 and vacuum showed favorable results in the control of fruit ripening.

These results may serve as the basis of improving the storage quality of the fruit in practice.

Professors SHI Jinhua [0242 2516 1472] and YUEN Yuesi [3162 3768 5837] reviewed the draft. LI Shuang [2621 2182 0948] and GU Wenmao [7157 3429 0602] took part in some work. LI Qimeng [7120 6428 6593] of Shandong Provincial Institute of Fruit Trees and SHI Shuang [1327 2883 5281] provided assistances. The authors thank the above mentioned persons.

Received 24 December 1978.

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TITLE: "Studies on Microbial Production of Long-Chain Dicarboxylic Acid from *n*-Alkane (I) Screening of Polyploid Strains of *Candida Tropicalis* Capable of Producing High Yield of Long-Chain Dicarboxylic Acid from *n*-Alkane"

SOURCE: Shanghai ZHIMU SHENLI XUEBAO [ACTA PHYTOPHYSIOLOGIA SINICA] in Chinese Vol 5, No 2, May 1979 pp 161-170

EXCERPTS FROM ENGLISH ABSTRACT:

A new screening technique was designed for the selection of dicarboxylic acid producing strains of *Candida* yeasts by using three strains of *Asinobacter* as the

[Continuation of ZHIMU SHENLI XUEBAO Vol 5, No 2, May 1979 pp 161-170]

test organisms. *Asinobacter* spp. I, C, and C₂ had been characterized by their different abilities of utilizing the *n*-alkane and dicarboxylic acids. All of these strains were capable of growing on the common monocarboxylic acids, whereas I, was also able to utilize the dicarboxylic acids of more than 6-carbon atoms, and C₂, the dicarboxylic acids of more than 8-carbon atoms, thus we could use these characteristics to screen the dicarboxylic acid producing mutants. Besides, a method for the quantitative determination of dicarboxylic acids using these test organisms was also described.

ZHANG Jinglin [1728 2529 0042] and CAI Baichen [3591 3843 3796] took part in some work.

Received 28 November 1978.

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TITLE: "Studies on Microbial Production of Long-Chain Dicarboxylic Acid from N-Alkane"

SOURCE: Shanghai ZHIMU SHENLI XUEBAO (ACTA PHYTOPHYSIOLOGICA SINICA) in Chinese Vol 5, No 2, May 1979 pp 171-179

EXCERPTS FROM ENGLISH ABSTRACT:

A mutant N-28, selected from *Candida tropicalis* T9, produced 10 g/l of suberate 1:10 dicarboxylic acid from n-pentadecane. With N-28 as the starting strain, using celastrol and complex as polyphosphorylating agents, we had obtained the polyphosphorylated

[Continuation of ZHIMU SHENLI XUEBAO Vol 5, No 2, May 1979 pp 171-179]

strain NPes 9 and NPes 10, with acid producing abilities of 17.3 g/l and 18.3 g/l respectively. Evidence for polyphosphorylation were as follows: 1) The size of the polyphosphorylated cell was larger than that of the control. 2) The growth rate was more rapid. 3) The cellular contents of DNA in NPes 9 and NPes 10 were 2.2×10^{-4} μ g/cell and 4.0×10^{-4} μ g/cell respectively, whereas that of the control strain N-28 was 1.0×10^{-4} μ g/cell.

Wu Wuying [0149 5019 3841] took part in the work. Thanks are due Li Yonghua [7120 2837 5478] of Shanghai Cell Biology Institute, Chinese Academy of Sciences for providing assistance.

Received 28 November 1978.

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PUBLICATIONS

SELECTED NEW SCIENTIFIC, TECHNICAL BOOKS

[The following list consists of 10 recently-published scientific and technical books selected from the first four issues of the (HAB-GUO XINSHU) (New Books Catalogue of the PRC).]

TITLE : WEIPIN JING GU LI
[Five Talks on Differential Geometry]
AUTHOR(S): Su Ding
PUBLISHER: Shanghai Science and Technology Publishing House
PUBLISHED: Oct 79
PRICE : 0.52 yuan
SOURCE : Beijing (HAB-GUO XINSHU) No 1, Jan 80 p 25

TITLE : SHULIANGUA LILUN JI QI YINGYONG
[Quantization Theory and Its Application]
AUTHOR(S): Deng Wenqun
PUBLISHER: Jilin People's Publishing House
PUBLISHED: Aug 79
PRICE : 0.83 yuan
SOURCE : Beijing (HAB-GUO XINSHU) No 1, Jan 80 p 25

TITLE : YING-HAN RELI CONGCHENG CILU/I
[English-Chinese Glossary of Thermal Engineering]
AUTHOR(S): Compiled by Xigu Thermal Power Plant and the central laboratory
of the Gansu Provincial Electric Power Industrial Bureau
PUBLISHER: Hydroelectric Power Publishing House
PUBLISHED: Oct 79
PRICE : 2.80 yuan
SOURCE : Beijing QUAN-GUO XINSHU No 2, Feb 80 p 31

TITLE : WEIBO LILUN YU JISHU
[Microwave Theory and Technology]
AUTHOR(S): Compiled by the Microwave Specialties Association of the China
Electronics Society
PUBLISHER: Science Publishing House
PUBLISHED: Feb 80
PRICE : 1.70 yuan
SOURCE : Beijing QUAN-GUO XINSHU No 2, Feb 80 p 32

TITLE : PAOWIAO LEIDA
[Artillery Laying Radar]
AUTHOR(S): Wu Qiyao
PUBLISHER: National Defense Industries Publishing House
PUBLISHED: Nov 79
PRICE : 0.64 yuan
SOURCE : Beijing QUAN-GUO XINSHU No 2, Feb 80 p 32

TITLE : YING-HAN JIASUQI CINHUI
[English-Chinese Glossary of Accelerator Terms]

AUTHOR(S): --

PUBLISHER: Science Publishing House

PUBLISHED: Jan 80

PRICE : 1.20 yuan

SOURCE : Beijing QUAN-GUO XINSHU No 3, Mar 80 p 28

TITLE : WEIBO JISHU JICHU (Shang ce)
[Fundamentals of Microwave Technology (Vol. 1)]

AUTHOR(S): Liao Cheng'en and Chen Dasheng

PUBLISHER: National Defense Industries Publishing House

PUBLISHED: Dec 79

PRICE : 2.15 yuan

SOURCE : Beijing QUAN-GUO XINSHU No 3, Mar 80 p 28

TITLE : YING-HAN HUAXIM HUADONG CINHUI BUBIAN (Yuanxinong Huaxue Bufen)
[English-Chinese Supplementary Glossary of Chemical and
Chemical Engineering Terms (Atomic Energy and Chemistry Section)]

AUTHOR(S): --

PUBLISHER: Science Publishing House

PUBLISHED: Dec 79

PRICE : 0.68 yuan

SOURCE : Beijing QUAN-GUO XINSHU No 3, Mar 80 p 29

TITLE : YING-HAN DIANZI XIANLU CISHI
[English-Chinese Glossary of Electronic Circuitry]

AUTHOR(S): --

PUBLISHER: Science Publishing House

PUBLISHED: Sep 79 (First Edition, Second Printing)

PRICE : 0.90 yuan

SOURCE : Beijing (XIAN-CHU XINSHU) No 3 Mar 80 p 48

TITLE : JIGUANG JI QI YINGYONG
[Lasers and Their Uses]

AUTHOR(S): Liu Zhongda

PUBLISHER: Liaoning People's Publishing House

PUBLISHED: Dec 79

PRICE : 0.72 yuan

SOURCE : Beijing (XIAN-CHU XINSHU) No 4, Apr 80 p 33

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